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ABSTRACT

The effects of the inclusion of literacy and numeracy competencies within Australia's civil construction industry training package were examined in a case study in Queensland. Data were collected through the following activities: interviews with trainers, workplace teachers, and workers; observations of training at an on-site training session on scaffolding; and a process of having respondents verify transcripts of their interviews. Little formal implementation of the civil construction training package in Queensland was discovered; however, training and assessment based on the civil construction competency standards was being provided at the company level. Although those interviewed generally recognized that

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literacy/numeracy competencies should underpin industry standards, there was a tension between managers' and trainers' commitment to providing such training and their commitment to complete their current construction project on time and within budget. (The bibliography lists 30 references. The following items are appended: the interview schedules; six tables detailing civil construction competency acquisition by workers at the case study site; an explosive power tools poster; a list of competencies taught in the scaffolding unit of competency; scaffolding assessment materials; comparison of diagrams of oxyacetylene equipment; oxyacetylene process and equipment handouts; and sample materials by the Performance Training Party, Ltd.) (MN)

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Adult Literacy and Numeracy Australian Research Consortium

ALNARC

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a case study of the effects of the inclusion of literacy and numeracy competencies within the civil construction industry training package

Ann Kelly & Jean Searle

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Faculty of Education
Griffith University

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All enquires in relation to this publication should be addressed to:
The Adult Literacy and Numeracy Australian Research Consortium (ALNARC)
School of Education
Victoria University
Footscray Park Campus
MCMC 14428
Melbourne VIC 8001

Email: alnarc@vu.edu.au

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Executive Summary

The contribution of the Queensland Centre to the national research project of ALNARC was designed to be conducted in two phases. Phase 1 involved a general survey of the uptake of training packages in Queensland. The purpose of this phase was to provide some general background data which would assist in building a national picture of some of the issues, processes and timing related to the application of training packages. Secondly, the survey allowed for a familiarisation with issues and key players in the state.

Phase 2 was a case study of one or more sites within a selected industry. There are a number of reasons why the civil construction industry was selected as an appropriate industry to investigate the effects of the inclusion of literacy and numeracy within one industry's training package on the quality of learning and work outcomes. Firstly, civil construction competencies had been in development since the early nineteen nineties; secondly, literacy and numeracy competencies were integrated into the standards; thirdly, the civil construction package had been implemented by the Vocational, Education, Training and Employment Commission (VETEC), the Queensland state training authority; and finally, there was a commitment at a number of levels within the industry to base training programs on the civil construction training package.

The two sites selected for examination in Phase 2 were both part of the Pacific Motorway project which was in its final stages of completion. This project involved five companies, each of which operated its own training site. Overall, 1760 workers have been employed on the Pacific Motorway project and the two companies selected for this study were major employers of these workers. A feature of the contract provisions agreed upon by the signatory parties was a commitment to training of workers using the civil construction training package.

During the period of the ALNARC study, a range of training programs was conducted on the two sites. These programs were provided by company trainers, external civil construction training consultants, and TAFE institute literacy and numeracy teachers. In some cases, these programs were based on materials that had been commissioned by the motorway companies as an alternative to those developed by ANTA to serve the civil construction industry generally.

Methodology adopted in the study

In order to achieve the objectives of the project, the first step taken was to develop two research questions. These were:

- To what extent have training packages been taken up in Queensland?
- What are the effects of the inclusion of literacy and numeracy in industry standards in training packages on the quality of learning and work outcomes?

Phase 1 of the project focused on the first question: *To what extent have training packages been taken up in Queensland?*. Two approaches were adopted in order to provide an 'environmental scan' of some of the issues related to the implementation of training and the assessment of competencies within training packages. The first approach was to gather information relating to the take up of industry training packages by talking to officers from the Department of Employment, Training and Industrial Relations (DETIR), Queensland, the Australian National Training Authority (ANTA) Queensland, and Education Queensland, as well as through searches of their websites. The second approach was to talk with trainers who were involved in delivering training and assessing competencies.

Phase 2 of the Queensland project focused on one specific training package, that of the civil construction industry. This phase addressed the question *What are the effects of the inclusion of literacy and numeracy in industry standards in Training Packages on quality of learning and work outcomes?* and is reported as a case study, comprising five elements:

1. The identification of the site and negotiating access
2. An interview with the Construction Industry ITAB training co-ordinator
3. An interview with a major provider of training for motorway employees
4. Observation of on-site delivery of training
5. Interview with two literacy/numeracy external trainers working on the motorway sites
6. On-site interviews with employees regarding their training, and
7. An interview with the developers of training materials to be used as an alternative to the non-endorsed ANTA materials for the civil construction industry.

In addition, the civil construction training package, including the non-endorsed components was examined. Some of these stages were overlapping and ethical clearance was sought at all stages from all participants.

Phase 1 Findings and Recommendations

At the time that these data were collected there was a trend for more traineeships to be approved than apprenticeships. In addition, while more than half the trainees were using training packages only 8.7% of apprentices were. However, this could have been a reflection of the recency and limited number of training packages which had been implemented at that stage. In the case of the civil construction industry, it would seem to be more practicable to adopt a traineeship rather than an *apprenticeship* model because *traineeships* would better fit the project-based employment patterns of the motorway construction industry.

Within the school sector, very few school traineeships had been registered generally and none involving Year 11 students within the civil construction industry.

Recommendations

It is recommended

1. A national research project be funded by ANTA in 2000:
   - to determine why certain training packages are more attractive than others, and
   - to identify ways to effectively market training packages.
2. The take up of civil construction traineeships and apprenticeships be monitored carefully to determine the success of the marketing and implementation of the civil construction training package.

Phase 2 Findings and Recommendations

A number of issues relating to the provision of training became evident as the ALNARC investigation proceeded. The primary issues included: the nature of the work and the workforce; the commitment by the two companies in the investigation to progressively reward employees with competency credentials and also positively favour those with such credentials when employing workers; and the importance of contextualising training.

- **The nature of the work, the companies and the workforce**

The competency standards for this industry have been developing since the early nineties and yet their take-up has been relatively slow. This is partly attributable to the fact that employees are hired for the life of each project, with each project varying in duration.

Another factor that characterises motorway work is the close relationship between weather conditions and material progress. In heavy rain, work ceases and because these companies cannot dismiss workers during this time, training is commonly conducted. However, when training is conducted at other times, it is often difficult to release workers to attend.

There are also differences across companies in their delivery and

assessment programs. With respect to the two companies involved in the ALNARC study, both were committed to training, yet the larger one appeared to be more successful in implementing the training packages than the other. There were a variety of reasons for this difference.

Finally, some workers often perceive little benefit from attending training sessions. The career path from labourer to tradesperson or foreperson is often difficult to traverse and financial benefit accruing from further training and credentialling is often not evident. This situation may change in the future, however, as is discussed in the following issue.

- **The commitment to training by the motorway companies**

Each of the five companies involved in the motorway project employed at least one trainer on-site. Some of these trainers delivered the majority of the company training, while others coordinated training delivered by outside providers. The training officers met regularly to discuss issues of current relevancy. A defining feature of the two sites investigated was the commitment of the training officers to training up all of their workers ultimately to Certificate level III standard.

Another feature of this commitment resulted from the terms of the contract that the employers signed. Since 1993 a ten percent training hour provision for apprentices, trainees and cadets relative to the total number of hours worked on a project has applied to all State Capital Works contracts over $100,000. However, the compliance rate in 1999 was poor. A recent review (2000) of this policy has recommended that the threshold of $100,000 be increased to $500,000 for civil construction projects and that sanctions against non-compliance be applied stringently. The motorway project has been exemplary in accepting a commitment to training and this is likely to continue in the future.

Four of the motorway companies and another which was constructing a busway believed that the ANTA non-endorsed learning materials were inappropriate for their purposes. Therefore they contracted a training provider to develop materials which are more appropriate to motorway workers and are presented in a 'user-friendly' way. To date, six units relating to Certificate level II units of competency have been developed with four more in preparation. Considerable effort is being spent in ensuring that the materials are customised appropriately. Drafts of materials are distributed to a network of trainers and supervisory staff for comment within an arbitrary time frame and these comments are then collated and relayed to the writers. The importance of this customisation and contextualisation of training is addressed further in the point below.

- **The contextualisation of training**

During the interviews with trainers and workers, a consistent theme addressed was the necessity for trainers to be experienced in civil construction. One trainer, when asked whether he perceived any differences between teachers and trainers, claimed that *"trainers are teachers with experience"*. When questioned further, he did not accept that there was high value in the years of theoretical learning that many qualified teachers had achieved and the ways that this learning might have been used reflexively in their practices. Rather, for him, experience 'on the job' was the major defining feature of an excellent trainer.

Data from interviews with students supported this belief, although there was also a conviction evident that basic skills were transferable. In addition, one of the trainers recounted that a worker had discontinued attending the numeracy program that was provided because he wished to learn how to 'screen' sand in the preparation of concrete and the numeracy teacher did not understand this technique.

This contextualisation issue has particular implications for adult literacy and numeracy teachers. As enterprise teachers, it is likely to be possible to understand the culture of literate and numeracy practices in a specific environment, but for others who only train workers at a site on a limited basis, there is a question of amount and depth of knowledge of the context that are necessary to ensure successful training.

- **The integration of literacy, numeracy and communication competencies into the civil construction training package**

While the integration of literacy, numeracy and communication competencies has usually been inserted into the civil construction training package in an integrated way, this is not the case for two elements of competency at Certificate level I, namely, *BCG1000 – Workplace communication and BCG 1004 – Carry out measurements and calculations*. Thus, it might be perceived that these two competencies are firstly, discrete; secondly, can be categorised in a similar way to the others that have been identified at this level, and thirdly, serve as pre-requisites to competencies at Certificate II and III levels in the package. We would not accept that workplace communication and measuring and calculating should be considered in this way. Both competencies should occupy a similar position to other literacy, numeracy and communication competencies that are treated as underpinning skills and knowledge and are inserted implicitly within broader competencies.

Recommendations

In considering the data that have resulted, the following recommendations are made:

3. That there should be further research within the construction industry, across all levels (management to construction worker), to explore the commitment to the integration of literacy and numeracy in training and the development of a training/learning culture.
4. That further research be conducted regarding the strengths and weaknesses of 'built-on' and 'built-in' approaches to the incorporation of literacy and numeracy competencies into technical competencies. While adult literacy/numeracy researchers and trainers would favour an integrated approach to literacy and numeracy competencies, the ABS survey figures (1966) indicate that the nominal hours that have been allocated for the acquisition of competencies may be inadequate because of the limited skills of construction workers.
5. That further research be conducted to identify models of good practice in the delivery of training based on the civil construction training package on motorway sites.
6. That further research be conducted into:
   a) the practices of making explicit the literacy and numeracy knowledge and skills that underpin technical competencies during assessment processes; and
   b) the identification of models of good practice in assessing this literacy and numeracy knowledge and these skills.
7. That in the next review of the civil construction standards framework, consideration be given to incorporating the following certificate level I units of competency into relevant technical units on the grounds that to separate these units provides a distorted view of their relevance to most other competencies:
   - BCG 100A: Carry out interactive workplace communication,
   - BCG1001A: Carry out OH&S requirements,
   - BCG1002A: Plan and organise work, and
   - BCG1004A: Carry out measurements and calculations.

1 Introduction

The contribution of the Queensland Centre to the national research project of ALNARC was designed to be conducted in two phases. Phase 1 involved a general survey of the uptake of training packages in Queensland. The purpose of this phase was to provide some general background data which would assist in building a national picture of some of the issues, processes and timing related to the application of training packages. Secondly, such a survey would allow a familiarisation with issues and key players in the state and could have led to the identification of one or more sites for Phase 2.

Phase 2 was to be a case study of one or more sites within a selected industry. The civil construction industry was selected as an appropriate industry to investigate the effects of the inclusion of literacy and numeracy within one industry's training package on the quality of learning and work outcomes for a number of reasons. Firstly, civil construction competencies had been in development since the early nineteen nineties; secondly, literacy and numeracy competencies were integrated into the standards; thirdly, the civil construction package had been 'implemented'[1] by the Vocational, Education, Training and Employment Commission (VETEC), the Queensland state training authority; and finally, there was a commitment at a number of levels within the industry to base training programs on the civil construction training package.

The two sites selected for examination in Phase 2 were both part of the Pacific Motorway project which was in its final stages of completion. This project involved five companies, each of which operated its own training site. Overall, 1760 workers have been employed on the Pacific Motorway project and the two companies selected for this study were major employers of these workers. A feature of the contract provisions agreed upon by the signatory parties was a special condition with respect to training motorway employees. Employers agreed to:

(a) provide a structured training program for on-site supervisors and workers on the site to improve their basic skills levels, and to assist in preventing a potential shortfall in skills availability in the construction industry; and

(b) provide all site personnel with suitable environmental training (Department of Main Roads, 1997, p. 6).

In addition, to ensure the effectiveness of this training, on-site supervisors and workers were to be assessed against the civil construction training package

1 The process of 'implementation' occurs after a packages has been endorsed nationally and involves each state training authority (in Queensland this is the Vocational Education, Training and Employment Commission, VETEC) determining the conditions under which the standards are to be implemented. These conditions relate to industrial relations, rates of pay, other traineeships/apprenticeship arrangements, nominal hours for training, payments for training, modes of delivery, and so on.

standards that had been endorsed by Construction Training Queensland, the state industry training advisory board for this industry. The results of this assessment process and the identification of skills shortages were to be recorded on a 'skills matrix' with each on-site supervisor and worker receiving a skills passport on the completion of the program. A further characteristic of the motorway training plan was the implementation of an on-going evaluation and reporting schedule to determine the success of the program. Reports of the training program were to be provided to the Superintendent every month and would include the names of supervisors and workers who had been assessed, had received an environmental induction, and had received training. Furthermore, the details of this training were also to be reported monthly.

During the period of the ALNARC study, a range of training programs was conducted on the two sites which were provided by company trainers, external civil construction training consultants and TAFE institute literacy and numeracy teachers.

2 Background

Beginnings of the training reform movement

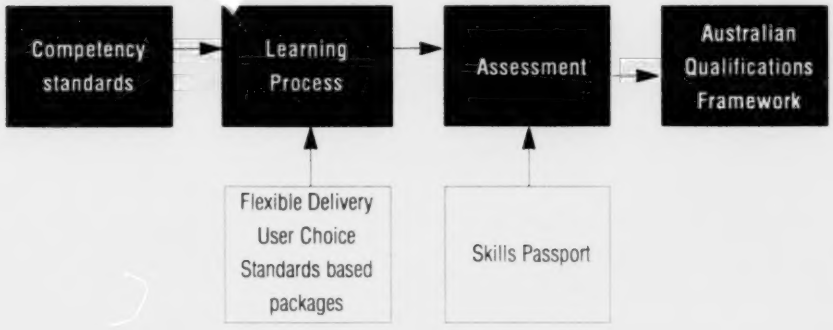
In August 1988, the Australian Conciliation and Arbitration Commission established a new wage system which focused on a Structural Efficiency Principle. Unions consented to co-operate in the overhaul of industrial awards to make them more relevant to the changing needs of modern industry and to allow for multiskilling the workforce in return for increased wages. The restructuring was to be underpinned by major reforms to skill formation and training arrangements. The implications for education and training were outlined by Dawkins (1988) in the report, *A Changing Workforce:* workers should be 'multiskilled' 'adaptable' and 'mobile', with the whole process being known as 'award restructuring'. Central to the policy was the reduction in the number of job classifications and demarcation between jobs, and the replacement of 'time-served' apprenticeships with a competency-based approach.

To this end, national standards in vocational education and training were to be developed by industry, consistent with a national framework developed by the newly established National Board of Employment, Education and Training (NBEET). Individual States and Territories also undertook to provide vocational education and training which would be consistent with the national standards (Dawkins, 1990). The focus was on worker competence and skill formation.

In 1990, the report, *Training Costs of Award Restructuring* (Deveson, 1990), identified the need for an open training market, a wider range of provision of private training, and skills formation linked to improved economic performance. One response to this situation was the formation of the Australian National Training Authority (ANTA) under the *One Nation* statement (Keating, 1992). ANTA provided a mechanism for the linking of training qualifications to industrial awards through the new Australian Standards Framework (ASF), which for the first time outlined a fully articulated accreditation pathway from entry-level training through to professional level. The Framework was seen as "a bridge between the competency requirements of work and work structures, and the vocational education and training and certification system" (Slee, 1992:16). Further, with the establishment of the National Framework for the Recognition of Training (NFROT) in August 1992, Australia had a national framework to ensure consistency in the accreditation and recognition of training. Industry, through 18 broad-based Industry Training and Advisory Boards (ITABs), argued that national curricula using such competency-based training modules would allow for greater flexibility in the workforce, remove many of the problems related to demarcation of jobs and allow for a more mobile workforce through the 'portability' of nationally recognised skills.

The National Training Framework

The National Training Framework came into operation in January 1998 in order to "streamline the relationship between industry bodies, training organisations, State and Territory authorities, and ANTA" (DETIR, 1997a:7). The National Training Framework consists of two interrelated components: the Australian Recognition Framework (ARF) and training packages. The Australian Recognition Framework (ARF) has been designed to replace the former accreditation of individual courses with a national registration of providers who can develop and deliver their own training and services. In Queensland, providers are registered through VETEC. Once registered, training organisations can provide assessment and can issue nationally recognised qualifications. The features of the new system are outlined in Figure 1.



Source: Literacy Link April 1997: 3

Figure 1: The Australian Recognition Framework (ARF)

In summary, the Australian Recognition Framework (ARF) has been designed to:

- ensure nationally consistent administrative arrangements through mutual state and territory recognition;
- simplify the way training is regulated;
- clarify the roles and responsibilities of different organisations within the training system;
- introduce audit arrangements of services and products; and
- establish a relationship between nationally recognised training packages, nationally recognised qualifications and nationally recognised training organisations (DETIR, 1997a:8).

The second component of the National Training Framework is the development of Training Packages. Training Packages are a set of national training resources, endorsed by ANTA's National Framework Committee, which registered training organisations can use as the basis for their training programs in specific industry areas. For each industry sector the packages will include endorsed and consistent competency standards, assessment guidelines and qualification levels which

align with the Australian Qualifications Framework (AQF). The following table (Table 1) presents the items which have been placed within the two categories, Endorsed and Non-endorsed Components, of all training packages

Table 1: Training Package Components

ENDORSED COMPONENTS		
Competency Standards	Assessment Guidelines	Qualifications
NON-ENDORSED COMPONENTS		
Learning Strategies	Assessment Materials	Professional Development Materials

Source: DTIR, 1997a: 8

The Civil Construction Competency Standards

The civil construction training package was endorsed by the National Training Framework committee in October 1998 and agreed to by Commonwealth, State and Territory Ministers in October that year (Australian National Training Authority, 2000). It covers key activities engaged in by both plant and non-plant operators in the civil construction industry. Plant operators in this industry typically operate a range of machines which include backhoes, graders, scrapers, front-end loaders, tractors and excavators. Non-plant operators generally engage in road making and maintenance, tunnel construction, rail and track laying, bridge and marine building and pipelaying.

The Civil Construction package has been developed to Australian Qualification Framework level III, with three further levels planned. The organisation of the standards for the industry is shown in Table 2 below.

Table 2: Framework for the Civil Construction Competency Standards

CODE	QUALIFICATION
BCC10109	Certificate I in Construction
BCC20198	Certificate II in Civil Construction
BCC30198	Certificate III in Civil Construction (Plant)
BCC30298	Certificate III in Civil Construction (Road Construction & Maintenance)
BCC30398	Certificate III in Civil Construction (Tunnel Construction)
BCC30498	Certificate III in Civil Construction (Bridge/Marine Construction)
BCC30598	Certificate III in Civil Construction (Foundation Work – Anchors/Piling)
BCC30698	Certificate III in Civil Construction (Railway Construction & Maintenance)
BCC30798	Certificate III in Civil Construction (Pipelaying)

Source: Construction Training Australia, 1998: 8

There are fifteen units of competency within the first level, fourteen of which have core or mandatory status. Furthermore, they are pre-requisites for later competencies. Eleven of these units are 'technical' in nature while the remaining four might be considered 'generic'.
These generic units of competency are:

- Carry out interactive workplace communication;
- Carry out occupational health and safety requirements;
- Plan and organise work; and
- Carry out measurements and calculations.

This particular selection of Certificate I competencies was developed primarily to reflect the Vocational Education and Training (VET) in Schools program and Labour Market Programs.

The Level II Civil Construction units of competency are drawn from the 1000 (Level I) and 2000 (Level II) series and are categorised as *core* or *elective* to reflect the foundational skills and knowledges required in the industry, as well as to allow for customisation to meet the needs of particular occupational groups. Training pathways leading to general construction, concreting and steelfixing have been developed at this level in response to the industry's needs and current work practices. As a result, there is a 'technical' orientation to the nine competencies that comprise this level and most of them have elective status. Only the units, *'Read and interpret plans'*, *'Assist with excavation and support installation'*, *'Repair pavements'* and *'Carry out concreting work'* are designated as mandatory.

At certificate level III, there are seven groups of competencies that have been selected as reflecting trade occupations in this industry. As can be seen in Table 2, these are:

- Civil Construction – Plant Group A,
- Road Construction and Maintenance,
- Tunnel Construction,
- Foundation Work – Anchors and Piling,
- Pipelaying,
- Railway Construction and Maintenance, and
- Bridge/Marine Construction and Maintenance.

All of these groups, with the exception of tunnel construction and railway construction and maintenance, have relevance to the motorway project.

Currently, traineeships are available for Certificates II and III (Plant) in Civil Construction. The nominal time periods for completion of these certificates is eighteen months and three years respectively.

The integration of literacy and numeracy into industry standards

The ALNARC project builds on foundations which have their origins in workplace adult literacy programs that have operated in Australian enterprises for over fifteen years (for example at the Nissan Manufacturing Company in Melbourne, as cited in Beaton, 1985). However, adult literacy and numeracy provision based on endorsed workplace competencies was not common until the early 1990s. At that time, two initiatives by the Commonwealth government were crucial in promoting the presence of literacy and numeracy programs within workplaces.

The first was the funding by the House of Representatives Standing Committee on Employment, Education and Training to conduct a study of the literacy and numeracy needs in the workplace (1990). Amongst a number of more general recommendations, this committee offered three that were relevant for the development of workplace literacy. These were that:

- the productivity, industrial relations and morale benefits of literacy and numeracy programs in the workplace be examined (p. viii);
- the National Training Board in ratifying competency standards developed by industry ensure that appropriate literacy and numeracy standards are included' (p. ix); and
- the Commonwealth Government ensure that employers are aware that workplace literacy and numeracy programs fulfil the training obligations of the Training Guarantee levy; and a proportion of the Training Guarantee levy funds collected through the Australian Taxation Office be directed to literacy and numeracy programs in the workplace (pp. ix).

The second Commonwealth Government initiative was even more important because it resulted in specific funding being allocated to adult literacy and numeracy training in the workplace. The Australian Language and Literacy Policy, which was adopted in 1991, following the tabling of the House of Representatives' report, *Words at Work* (1990), allocated $11m to be available through the Literacy in the Workplace Program between 1991 and 1995 for the assessment and training of the language, literacy and numeracy skills of employees in specific enterprises. The name of the program was subsequently changed to the Workplace English Language and Literacy Program. There were a number of features of this program that were designed to contribute to the success of the delivery of workplace literacy and numeracy courses. Firstly, the organisation of the courses was to be managed through a tri-partite process involving representatives from enterprises, relevant unions and training delivery systems. Secondly, employers were required to contribute financially, in an incremental way. Finally, it was preferred that courses would be conducted in paid work time. While the quality of these programs was somewhat variable, the success of the program is attested by its continued existence.

During the early 1990s there was a plethora of publications that

documented and reported on workplace literacy and numeracy programs. For example, within the textiles, clothing and footwear (TCF) industries, an early project by the New South Wales English Migrant English Service and TAFE New South Wales (Bayliss, Caldwell & Nussbaum, 1991) showed how language and literacy task analyses of operators across the range of TCF industries could be conducted. The report writers also emphasised the importance of conducting such analyses to ensure that subsequent programs were relevant to the specific workplaces in which training was delivered. These analyses focused on the written and spoken communication requirements of tasks and thus pointed up the language and literacy demands made on operators who performed these tasks. In addition, samples of texts used by these operators were collected. There were also a number of texts published to assist teachers in their role as workplace trainers. One example of a case study of exemplary practice was that written by Lynda Hamilton in 1992. Also, a *Self-study Guide for Teachers* who worked in enterprises was developed by Dianne Prince (1992).

In addition to providing funds for the delivery of workplace language, literacy and numeracy programs and for the production of materials for teachers and course developers of such programs, the Commonwealth Government also adopted the recommendation by the House of Representatives Standing Committee (1990) to incorporate English language, literacy and numeracy competencies into the standards documents that were being developed. To achieve this, the Australian Language and Literacy Council (ALLC) undertook an investigation and evaluation of different models for incorporating these competencies into standards (National Board of Employment, Education and Training, 1993). Two types of models, *explicit* and *implicit*, were evident in the analysis of the fourteen sets of standards that had been endorsed by the National Training Board documents at that time. The Council noted in its report that there were problems with both models. They argued that if language, literacy and numeracy competencies were stated in an explicit way, they might be exaggerated and not reflect actual task demands. This would have implications for training and assessment practices, and ultimately for job security. In contrast, where such competencies were not visible in standards documents, then they were likely to be ignored. Despite the difficulties in determining how best language, literacy and numeracy competencies might be incorporated into industry standards, the State and Commonwealth Education Ministers agreed in 1995 that in the developing of competency standards, the underpinning literacy and numeracy knowledge and skills would be incorporated in an explicit way.

In a second study, three years after their earlier one, the ALLC undertook research in the warehousing and distribution industry to examine "possible and practicable approaches" whereby the incorporation of language, literacy and numeracy competencies might be accomplished (National Board of Employment, Education and Training, 1996, p. iii). The Council report again recommended that these competencies be incorporated *explicitly* into standards and concluded

that four options were available to accomplish this work. These all required additions to the standards, that is, *additions* of units, elements, performance criteria or information relating to the range of variables or the evidence guide (p. 5). Thus, all currently endorsed training packages should contain language, literacy and numeracy competencies, although reference to them might be found in any one of these four categories.

Literacy and numeracy in the civil construction industry standards

While the level of trade qualifications within the building and construction industry is high relative to some other industries, there is a common view that the literacy and numeracy skills of the construction workforce are substantially weaker than those of the general Australian workforce. Until recently, there was little published evidence to substantiate this view. However, the Australian Bureau of Statistics 1966 study, *Survey of Aspects of Literacy (Building and Construction Industry Workforce 2005*, 1999) provided data to show that both the *literacy* and *numeracy* skills of the construction workforce were indeed more limited than those of other workers. Further, this survey showed that the numeracy skills of workers aged 15-34 were, on average, considerably weaker than those of older workers in this industry. Details of these findings are reproduced in Table 3 below.

Table 3: Literacy Skills of Construction Workers, by Age Compared with those of the General Workforce (indicated by brackets)

	Levels1/2 Limited skills % of workforce	Level 3 % of workforce	Levels4/5 High skills % of workforce
Prose skills			
15-34 years	50.1 (35.4)	37.5 (42.1)	12.4 (22.5)
35-74 years	58.2 (40.8)	31.2 (37.7)	10.6 (21.5)
Document skills			
15-34 years	50.7 (34.6)	38.7 (44.4)	10.6 (21.0)
35-74 years	51.5 (40.3)	38.8 (39.7)	10.4 (20.0)
Numeracy skills			
15-34 years	45.9 (35.0)	42.2 (43.8)	11.9 (21.2)
35-74 years	41.5 (37.2)	42.4 (39.0)	16.1 (23.8)

Source: Building and Construction Industry Workforce 2005 (1999)

When developing and revising the civil construction competency standards, there was an intention to incorporate literacy and numeracy competencies within them in an *implicit* way. This would appear to have been achieved. For example, Table 4 lists the elements of competency and the related performance criteria that have been endorsed for the unit of competency, *BCC2006A: Erect/dismantle fencing and gates*, a competency that has been

selected at random to illustrate the implicit nature of the inclusion of literacy and numeracy competencies.

Table 4: Unit of Competency: BCC2006A – Erect/dismantle fencing and gates

Element of competency	Performance Criteria
1. Plan and prepare work	1.1 OH&S requirements adhered to. 1.2 Quality Assurance requirements recognised and adhered to. Location of fencing and gates determined from site plans. Materials and quantities determined from site drawings and specifications. 1.5 Personal protective equipment selected, correctly fitted and used. Tools and equipment selected consistent with requirements of the job.
2. Erect fence	2.1 Fence line and post hole position set out to requirements of site plans and specifications. Post holes excavated to specifications. Fence posts erected in place, plumb and to alignment in accordance with specifications. Fence rails and cladding or mesh fixed to posts to specifications.
3. Erect gates and signage	3.1 Gates fitted and secured to requirements of site drawings and specifications. 3.2 Signage installed at entry gates in accordance with site OH&S and security requirements.
4. Maintain fencing and gates	4.1 Fencing and gates maintained to completed construction condition.
5. Remove and make good	5.1 Gates and fencing dismantled and removed from site where required. 5.2 Area made good to specification.
6. Clean up	6.1 Tool and equipment cleaned, maintained and stored. Waste and unwanted material cleared and removed from site. Tools and equipment cleaned, maintained and stored.

Source: Construction Training Australia, 1998: 1 of 3

The Evidence Guide that accompanies this element of competency identifies the following 'critical' aspects of evidence:

- compliance with Occupational Health and Safety regulations and state/territory legislation applicable to workplace operations;
- compliance with organisational policies and procedures including Quality Assurance requirements;
- correct procedures during construction;
- safe and effective operational use of tools, plant and equipment and communications to enable appropriate erecting/dismantling of fencing and gates (p. 2 of 3).

The Underpinning Knowledge and Skills have been determined as follows. Competent workers are required to demonstrate a knowledge of:

- workplace and equipment safety requirements;
- measurements;
- hand tools and equipment;
- materials and handling methods;
- Quality Assurance;
- workplace communication; and

the ability to

- work safely to instruction;
- use power tools and hand tools;
- handle material;
- select material;
- apply Quality Assurance;
- communicate effectively (p. 2 of 3).

Within this certificate level II competency, the literacy and numeracy demands that are placed on workers are high. As can be seen by the items in the lists above, workers are expected to be familiar with relevant occupational health and safety requirements as well as organisational requirements, including those pertaining to quality assurance. It might be presumed that these are documented within individual enterprises and it would be necessary for workers to use this documentation, even if in a simplified form, when erecting and dismantling fencing and gates. Furthermore, competent workers are required to be able to interpret site plans, site drawings and specifications (performance criteria 1.3, 1.4, 2.1, 2.2, 2.3, 2.4, 3.1 and 5.2) and to measure correctly (underpinning knowledge). Finally, they must be able to "communicate effectively" (underpinning skills). Exactly what is entailed in these processes is not made clear. As a result, it might be conjectured that the task of assessor is rendered quite difficult in confidently developing assessment tasks that ensure that the demands placed on the certificate level worker are valid and fair.

While all the literacy and numeracy competencies that underpin the technical competencies within the civil construction training package would appear to be incorporated generally in an implicit way as exemplified in Table 4

above, there is one case in which numeracy competencies are made explicit. Within the Certificate I set, the element of competency, *BCG1004A: Carry out measurements and calculations,* is designed to be very explicit about the kinds of numeracy knowledge and skills that are required to underpin later competencies. Table 5 lists the three elements of competency and the performance criteria that have been endorsed for this purpose.

Yet even within this element of competency there is an assumed seamlessness between numeracy and literacy practices. The performance criterion 1.1, for instance, involves practical measurements that are dependent on procedures that have been ratified within a company and given authority in the form of "job instructions".

It must be noted, however that while the adult literacy/numeracy field welcomes the incorporation of literacy and numeracy competencies within technical and other competency statements but question the appropriateness of the decontextualised elements of competence such as 2. *Perform simple calculations* as shown in Table 5. There is a very real danger that when specific literacy and numeracy competencies are treated in such an implicit way, that they will be ignored and the underpinning skills and knowledge will not become visible within the assessment and training regime. One of the goals of the Queensland ALNARC study was to show how these literacy and numeracy competencies were made visible within the training programs that were implemented on the motorway sites.

Table 5: Unit of competency: BCG1004A – Carry out measurements and calculations

Element of competency	Performance Criteria
1. Obtain measurements	1.1 Accurate measurements obtained according to job instructions using rule, tape and/or square 1.2 Quality Assurance requirements associated with company's construction operations recognised and adhered to
2. Perform simple calculations	2.1 Simple calculations involving length, perimeter, mass and volume using basic operations (+, -, x, /)
3. Estimate approximate quantities	3.1 Measurements or quantities estimated (approximately) on site or from job instruction 3.2 Information obtained correctly from job instruction 3.3 Measurements correctly identified/recorded without error 3.4 Quantities of materials suitable for work undertaken are calculated and recorded to job instructions 3.5 Costs for simple project estimated to within + or – 10%

Source: Construction Training Australia, 1998: 1 of 3

3 Methodology

Focus of the study

In order to achieve the objectives of the project, the first step taken was to develop two research questions. These were:

- To what extent have training packages been taken up in Queensland?
- What are the effects of the inclusion of literacy and numeracy in industry standards in training packages on the quality of learning and work outcomes?

Phase 1 of the project focused on the first question: *To what extent have training packages been taken up in Queensland?*. Two approaches were adopted in order to provide an 'environmental scan' of some of the issues related to the implementation of training and the assessment of competencies within training packages. The first approach was to gather information relating to the take up of industry training packages by talking to officers from the Department of Employment, Training and Industrial Relations (DETIR), Queensland, the Australian National Training Authority (ANTA) Queensland, and Education Queensland, as well as through searches of their websites. The second approach was to talk with trainers who were involved in delivering training and assessing competencies.

In order to investigate the effects of the inclusion of literacy and numeracy in industry standards in Training Packages on quality of learning and work outcomes, it was decided that Phase 2 of the Queensland project should focus on one specific training package, that of the civil construction industry. This phase, which is reported as a case study, consisted of five elements:

1. the identification of the site and negotiating access;
2. an interview with the Construction Industry ITAB training co-ordinator;
3. an interview with a major provider of training for motorway employees;
4. observation of on-site delivery of training;
5. interview with two literacy/numeracy external trainers working on the motorway sites;
6. on-site interviews with employees regarding their training; and
7. an interview with the developers of training materials to be used as an alternative to the non-endorsed ANTA materials for the civil construction industry.

In addition, the civil construction training package, including the non-endorsed components were examined. Some of these stages were overlapping and ethical clearance was sought at all stages from all participants.

Three aspects of the methodology, interviewing, observations and member-checking, are considered below.

Interview techniques

In this project, use was made of three approaches to interviewing (Patton, 1991). Firstly, as the project officer was present as an observer in several on-site training sessions, she made use of *informal conversational interviews* to gain perceptions of the training as it was being delivered. For interviews with the trainers, use was made of a *standard interview guide* (see Appendices A[1] and A[2]). However, when interviewing the workers/trainees, a more informal *open-ended interview* approach was adopted which revolved around questions such as: How did you hear about this course? Why did you volunteer for this course? What have you found useful about it? What has not been so useful? (See Appendix A[3]). Audrey Grant's (1987) model was used as a guide in the interviewing process. This model is encapsulated in the following quote.

> *The interviews followed an open structure, with the aim of taking seriously the interviewee's own perspectives, experience and ways of evaluating things. Thus instead of a standard schedule, questions within common topic areas were adapted to each interviewee's responses and particular situation. (p.4)*

All interviews were audio-recorded and transcripts produced.

Observations

Fundamental to the success of this project was the role of the project officer as an observer of the delivery of training and in some cases, as a participant observer. In this role, the project officer attended an Occupational Health & Safety meeting, an on-site training session which focused on *Unit BCG1007A: Erect and Dismantle Restricted Height Scaffolding* of the civil construction standards, a 'toolbox' meeting and literacy/numeracy classes conducted under the Training Fund provisions. Data collection included the writing of field notes which were later expanded in as much detail as possible in an attempt to provide a concrete account of the activities in which trainers and trainees participated, the language and terminology used, and the mode of the delivery of training. Also, samples of the resources used were collected.

Member-checking

In the interests of truly collaborative research it is important that the emancipatory or empowering aspects of research are allowed for in the methodology. One way of ensuring this, while also maintaining credibility, was through the use of member checks (Mertens, 1998)[2]. In view of this, transcripts of interviews were provided to respondents following the interview, for verification purposes. The amount of time available for this process was not ideal given the short time frame for the study. Also, because of the nature of the site,

2 Member checks are defined by Mertens (1998) as the "verification with the respondent groups of the constructions that are developing as a result of data collected and analysed" (p. 182).

which was in its final stage of operation when the Queensland ALNARC project commenced, not all member checks were completed. In signing an agreement form to participate in the study, workers, trainers and teachers were promised a brief summary of the project and this will be provided to all participants.

4 Findings

Phase 1: To investigate to extent to which training packages have been taken up in Queensland

Web searches and interviews with relevant government departmental officers.

The first process in gathering information relating to the take-up of industry training packages in Queensland combined searches of relevant websites (ANTA, DETIR and a number of ITABs) and conversations with officers of ANTA, (Queensland), DETIR and Education Queensland. A search of the DETIR (1999) website revealed the following information.

Between 1 July 1999 and 30 September 1999 (the latest period in which statistics had been published at the time of the study), there were 2 907 apprentice new approvals recorded. This represented a 33.8 increase on the same period in the previous year. However, only 253 of these apprentices (8.7%) were working with training packages. In the case of continuing apprentices, at 30 September 1999, the figure was 25 142, which represented an increase of 8.1% relative to the number recorded in the same period of the previous year. 624 of these new apprentice approvals were for construction tradespersons. This represented 21% of the total number of apprentices registered for this quarter in Queensland and an increase of 33% on the previous year.

For trainees, the figure is much larger. In the period from July to September 1999, there were 6 262 traineeship new approvals. This compares unfavourably with the figure of 7 277 during the same period in 1998 – a decrease of 13.9%. However, 53% of these newly approved trainees are using training packages. This figure contrasts strongly with the 8.7% figure for apprentices cited above. Another contrast is with the number of trainees in the third quarter of 1999 relative to that of the same period of 1998 (28 844). This represents an increase of 27.7%. Most trainees were contracted to complete Certificate II (969), III (4 944) and IV (1 157) in the Business area, that is, in Office Administration. The next largest industry group was that of Retail Operations with 2 515. There were also significant numbers of trainees in the Hospitality industry (2 285) and a substantial, but smaller number in Meat Processing (Abattoirs) (516). Noticeably, there were no civil construction trainees registered and thus none using the civil construction training package (DETIR, 1999a).

Within the school sector, the number of apprentices and trainees is virtually negligible. In July 1999 there were three Year 12 students enrolled in construction, from a total of seven Year 12 students enrolled in apprenticeships and traineeships. However, only six of these are pursuing competence within the training package framework. There were no Year 11 students signed up in a

construction training package program although there were six students enrolled in other training package programs (DETIR, 1999a).

Conversations with officers from both Education Queensland and DETIR resulted in views about the take-up of training packages which ranged from: *"It's probably too early to be looking at the implementation of training packages"* to: *"At this stage* (June, 1999) *only four training packages have been 'implemented' in Queensland"*. It was also noted that the major provider of VET training in Queensland, TAFE Queensland, was not due to deliver training through training packages until 2000.

In Education Queensland, the School Based Traineeship Section is responsible for developing guidelines (based on DETIR guidelines) for submissions for funding for literacy support for trainees. At the time of the ALNARC study however, few schools had sought such funding. This may be attributable to the fact that the number of traineeships involving school students that have been registered is very limited.

Emergent Issues from Phase 1

- At the time that these data were collected there was a trend for more traineeships to be approved than apprenticeships. In addition, while more than half the trainees were using training packages only 8.7% of apprentices were. However, this could have been a reflection of the recency and limited number of training packages which had been implemented at that stage. In the case of the civil construction industry, it would seem to be more practicable to adopt a *traineeship* rather than an *apprenticeship* model because traineeships would better fit the project-based employment patterns of the motorway construction industry.
- Within the school sector, very few school traineeships had been registered generally and none involving Year 11 students within the civil construction industry.

Recommendations

It is recommended that:

1. A national research project be funded by ANTA in 2000:
   - to determine why certain training packages are more attractive than others, and
   - to identify ways to effectively market training packages.
2. The take up of civil construction traineeships and apprenticeships be monitored carefully to determine the success of the marketing and implementation of the civil construction training package.

Phase 2: To investigate the effects of the inclusion of literacy and numeracy in industry standards in training packages on quality of learning and work outcomes

As reported in the Methodology section, Phase 2 of the Queensland project focused on issues related to the implementation of one specific training package, that of the civil construction industry. This phase, which is reported as a case study, consisted of seven elements:

1. the identification of the site and negotiating access;
2. an interview with the Construction Industry ITAB training co-ordinator;
3. an interview with a major provider of training for motorway employees;
4. observation of on-site delivery of training;
5. interviews with two literacy/numeracy external trainers working on the motorway sites;
6. on-site interviews with employees regarding their training; and
7. an interview with the developers of training materials to be used as an alternative to the non-endorsed ANTA materials for the civil construction industry.

1. The identification of the sites and the negotiation of their access

It was thought that one way of accessing workplaces was to capitalise on the presence of language, literacy and numeracy teachers who were currently implementing WELL programs on-site. Not only might they act as mediators to gain entry to the site, but they might also be important sources of data. However, in Queensland the on-site language and literacy and numeracy teachers were generally operating outside of industry training package delivery models.

A second strategy for accessing work sites was via vocational teachers who were delivering programs on-site which were based on industry training packages. However, two problems became evident in the process of investigating this option. Firstly, teachers and trainers were often not *delivering* training in a face-to-face mode but rather using the learner workbooks that had been developed as part of the unendorsed component of the training packages as a stand-alone learning technology. Alternatively, they were continuing to use workbooks that had been prepared prior to the introduction of industry standards for this purpose.

As these avenues were being explored, a number of face-to-face and telephone discussions were held with ANTA and DETIR officers and suggested contacts were followed up. Secondly, negotiations were taking place between a TAFE Institute, Construction Training Queensland, and contractors on a motorway project to develop and conduct literacy and numeracy assessments and to deliver a literacy/numeracy program to assist motorway workers to acquire Civil Construction Certificate II competencies. Although the intention of the

Queensland ALNARC project was to investigate the *integration* of literacy and numeracy within broader delivery models, the motorway project was selected as it fitted the criteria that Marshall and Rossman (1995) suggest comprise an *ideal* site, namely: credible and reliable data, access, trust and a richness of data. Marshall and Rossman's final criterion of a "high probability that a rich mixture of the processes, people, programs, interactions and structures of interest" was also present (p. 51). Six construction companies were involved in the motorway project with each of them employing at least one trainer, although training was not always the sole occupational role of these personnel. These trainers were delivering or organising the delivery of a range of training programs, some of which were based on the civil construction standards. It was decided to focus the project on two of the sites which delivered training in relation to the civil construction training package.

2. Interview with ITAB training co-ordinator

In a meeting, held with the Executive Officer of Construction Training Queensland and other parties, the possibility of conducting research in the civil construction industry was raised. The initial response was that it was too early as the training package conditions for implementation had only recently been approved. However, the training co-ordinator for the ITAB was interested in the ALNARC project. He gave his support and served as an advocate for the project. It was his belief that all construction workers needed to be competent at level 3 and the ALNARC project was perceived to be useful to document aspects of this process. As a result of his work, the ITAB gave their support. In an interview with this co-ordinator it emerged that he had played a primary role in the development of the civil construction standards. He began the interview by giving some background information before focusing on the competency standards and the integration of literacy and numeracy competencies within them.

Background

The Building and Construction Industry Taskforce was established in July 1998 as part of the Queensland Government's 'Breaking the Unemployment Cycle' policy. Specifically, it was given the task of implementing the commitment of the State Government to the Building and Construction industry. The government's policy aims at revitalising the industry and stimulating the creation of new jobs. More specifically, the commitment includes the introduction of a training fund equivalent to 0.05% of building and construction activity, the extension of long service leave benefits and the rationalisation of the levy/fee collection process. In accepting this policy, the companies who signed the contract with the state government for the construction of the Pacific Motorway project agreed to fund the training and assess the skills of their workers.

Industry standards and integration

The following points were made by the training co-ordinator of Construction Training Queensland during an interview with the ALNARC project officer.

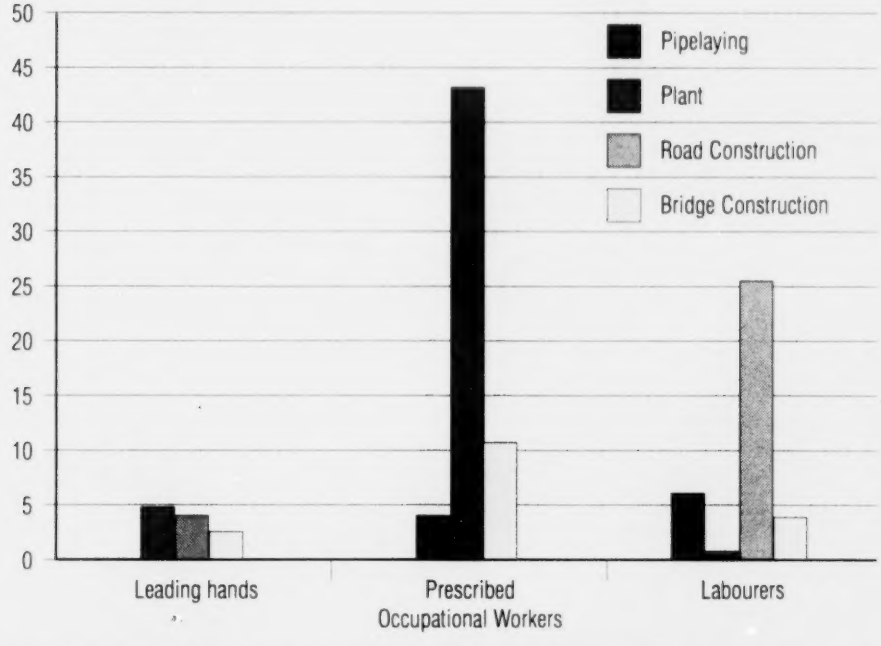
- Prior to the 1990s, civil construction training occurred on an ad hoc basis. With the implementation of a competency-based system, an attempt was made to provide a theoretical basis for practical experience.
- In the early stages, there was a binary approach taken to competence. Workers were either *competent* or *not competent*. Since then, however, the concept of competence has expanded to include the dimension of adaptation to meet unforeseen circumstances. This aspect is particularly important in the construction industry where every project is unique.
- In the process of developing the standards, the occupational health and safety requirements that already existed in the industry (for example, the certification requirements of the equipment used) needed to be included.
- In addition, underpinning literacy and numeracy competencies were considered. For the most part, these are implicitly included.
- In delivering literacy and numeracy training, it was emphasised that this must be achieved by integrating it into other training. *"In effect, a labourer has to be able to understand what the language is, how to apply that language, talk in that language to the engineer as well as other workers, and understand what it's about. And of course, the other part of the competency requirement is to be able to complete the associated paperwork. Every day he [sic] has to fill out a series of activities of what he's done for the day: a time sheet, so to speak. So, a time sheet, in actual fact, is a literacy component"*. A similar case was made for numeracy, particularly at Certificate levels II and III.
- The conditions under which work was organised have changed. In the past, there may have been one foreman responsible for a single job but now this responsibility extends over a number of jobs. As a result, all workers need to attain Certificate III competencies so that they can act autonomously in making decisions and these must be *"correct decisions, based on the information that is available to them"*.
- There was a strong belief across all levels of the industry that the acquisition of competencies was very important but effecting this training was difficult because of the following factors: the uncertain but critical weather conditions, and the difficulty of releasing workers.
- There was a belief that links between pay and skill, in the form of credentialled competencies, would become stronger in the future. As a result, the current inequitable situation where people are paid different amounts for engaging in the same work would lessen.

It was also believed that while technological innovations were likely to make the completion of jobs quicker and more accurate, there would still be the need to use this new equipment in a competent way.

3. Interview with a major provider of training for motorway employees

At Site A, which is one of two sites or 'packages' where the major provider operated, there were 106 employees. Figure 2 below shows the proportions of the three groupings of these employees, namely leading hands, those who have prescribed occupations and labourers. There were a total of 11 leading hands, 59 prescribed occupational workers and 37 labourers. These groups were further differentiated by the particular streams of work in which they engaged. There was a predominance of plant workers (49), fewer road construction workers (30), 16 bridge construction workers and only 11 employed within the pipelaying stream. As will be evident below in the section relating to competency training, these categories are important in determining the training paths that are available and taken up.

Figure 2: Employee Groups



Prescribed Occupational groups of workers: Formsettter (10), PO Loader (8), PO Grader (7), PO (6), PO Roller (5), PO Excavator (4), PO Compactor (3), PO Dozer (2), Pipelayer (2), PO Truck Operator (2), Crane Operator (2), OP Paver (2), PO Truck Operator (2), Batch Plant Operator (1), PO Crane Operator (1), Crane Truck Operator (1), Dogman (1), PO Paver (1).

The training system operating is quite decentralised. While a number of trainers are employed permanently by the company to conduct training, a decision has been taken to train supervisors and forepersons to conduct training for their own teams of workers. Thus, workplace assessor courses, as well as the civil construction competencies and specific workplace information courses, such as orientation sessions, are provided on-site. In addition, there has been a concerted attempt made by the company trainers to assess all workers' skills and RPL or train them to level II standards. As a result, most of the labourers and

tradespersons have attained this level of competency. The tables presented in Appendix B (B[1]), (B[2]), and (B[3]) show the level of attainment of competencies at Levels I, II and III respectively at this site.

As can be noted in the table in Appendix B(1), most of the Certificate I competencies have been assessed through a process of recognition of prior learning. A major exception is the competency *BCC 1014 – Control construction traffic* where half of the employees have received training on site. Other significant elements of competency where training has been delivered on site are that of *BCC 1003- Drain and de-water site and BCG 1004 – Carry out measurements and calculations* where just over a quarter and just fewer than a quarter respectively of the employees have received such training. In addition, it can be noted that very few employees are competent in the scaffolding element of competency at this level.

From Appendix B(2), it can be seen that the attainment of competence of the elements in Certificate II is not so advanced. Over half of the employees have been deemed competent in five of the competencies:

- BCC 2001 – *Read and interpret plans*,
- BCC 2003 – *Assist with excavation and support installation*,
- BCC 2005 – *Repair pavements*,
- BCC 2006 – *Erect and dismantle fences and gates*, and
- BCG 2008 – *Use explosive power tools*.

Only two of these elements have been designated as core competencies. The fifty per cent figure of attainment is likely to under-represent the level of competency for these elements as a substantial number of other workers have been trained, but not assessed, as competent at this stage. Another feature of this table (Appendix B[2]), when compared with the previous one, is the much higher level of competence that has been acquired on the job.

In order to be considered competent as a Certificate III tradesperson, all workers must acquire all of the core Certificate I and II competencies (with the exception of pipelaying for plant and bridge construction tradespeople) and a mix of core and elective elements of competency at Certificate III. The tables presented in Appendices B(3a), B(3b), B(3c) and B(3d) list the acquisition level of the 28 elements of competency that comprise the requirements of a Certificate III qualification for the four trades of pipelaying, plant, road construction and bridge construction respectively that are relevant for this site.

From the table in Appendix B(3a) it can be seen that a number of workers have gained the knowledge and skills necessary to be been assessed as competent for five of the eight elements prior to their employment at this site. However, two workers have acquired their competence in the element BCC 3036 – *Spread and compact granular materials*, the most popular one, on site. The total numbers of competent pipelayers, however, is small. To be competent as a plant operator, in addition to the level I and II competencies discussed above, workers must acquire one of the elements shaded in the table presented in Appendix (B3a) and two of the remaining elements. It is noticeable that in

contrast to the situation for pipelayers, a significant number of workers are competent plant operators.

When the requirements for competency as pipelayers and road constructors are compared, it can be seen that there is considerable overlap of the elements of competency in the civil construction training package. However, the total number of competencies that road constructors must acquire is much greater. As well as the Certificate I and II competencies, this group of tradespeople must be competent in the four shaded elements and three of the electives. (See Appendix B[3c]). It can be noted that while over half of the Site A complement of workers have been assessed as competent as traffic controllers, the number who are competent road constructors is very few.

Of the four types of trade that are relevant to Site A, the set of four core competencies (shown in Appendix B3[d]) is the full complement of competencies required for recognition as a bridge/ marine construction and maintenance tradesperson. This set is the smallest number of elements that are required for any prescribed occupational group on the motorway. When considering the total nominal hours that have been determined for the four groups, those applying to bridge/marine construction and maintenance are also the lowest at 360 hours. This compares with 384 hours for pipelaying, 568 for road construction and the extensive 2960 hours for plant operators.

In total, at the time of recording this information at this site, 23 workers had completed Certificate I, six workers had completed Certificates I and II, and five had completed Certificates I, II and III of the civil construction training package and had thus acquired a significant number of underpinning literacy and numeracy competencies as well as the technical ones. In addition, a special allocation of money from the Building and Construction Industry Training Fund was being used to support a literacy/numeracy program which was delivered by TAFE Institute literacy teachers.

4. Observation of on-site delivery of training

Two examples using a 'built-in' approach to integration of literacy/numeracy competencies

At Site A, one method used to train workers informally is through the use of posters during weekly 'toolbox'[3] meetings which are approximately one hour's duration. Topics for these meetings may include civil construction competency topics. An example of a tool box poster that is reflective of a unit of competency at Certificate level II: *BCG 2008 – The use of explosive tools* is presented in Appendix C.

A number of strategies are used in posters to ensure that they are 'reader/listener friendly', long-lasting and available for additional informal as well as formal training sessions. These are listed below.

3 This term is site-specific and does not refer to ANTA's 'toolboxes'.

- They are printed on A3 sized paper so that they are clearly visible.
- They are laminated to assist in their longevity.
- A range of font sizes, font types and colours are used to separate different levels and categories of text. For example, the words in the list denoting the *strength* of explosive charges have been printed in the appropriate colours.
- A range of graphics are used effectively to support the words in the text. In the case of the explosive charge poster, both cartoons and photographs are relevant and used to effect.
- The information that is featured has been selected for its importance.
- The information is organised into accessible sections with each section identifiable by a heading. For example, the explosive charge poster has three different sections of information:
    - the colour code list mentioned above,
    - three specific instructions for use, and
    - a "storage and use" category which contains seven separate points.
- [It might be noted that the three points that comprise the second section: Misfire – Do not remove tool from work surface for at least 10 seconds; Mechanical Failure – Return to manufacturer for repair; and Minimum edge Clearances – concrete and masonry 75 mm and – steel 12 mm would fit within the "storage and use" category.]
- A considerable number of elements in the unit of competency: *BCG2008 – Use explosive power tools* has been addressed within the text of the poster. Table 6 (on the facing page) shows the match between the points in the poster and the elements of competency and their performance criteria within the standards for this unit.

At the time of the interview with the training co-ordinator (see previous section), 75 posters had been developed. As they are produced, they are distributed to forepersons with the intention that they be filed progressively in a ring binder and thus be available for use as required. In addition to their availability as laminated paper texts, they are also copied to a compact disk and a support video has been produced for wider distribution. Thus, the 75 posters, the disk and the video are assembled as a kit that is being perceived nationally as serving as a 'model' initiative throughout the company. As a result interest in its use is high.

At Site B, the second motorway site for the ALNARC project, a training session on scaffolding, a component of the Certificate I in Civil Construction: *BCG1007 – Erect and dismantle restricted height scaffolding* was conducted by the resident trainer. (See Appendix D for a list of the elements of competency, the performance criteria and a selection of relevant aspects of the evidence guide relating to this unit of competency.) (Appendix E contains a copy of the observation checklist and written assessment that was used to determine competence in ability to erect and dismantle such scaffolding.) Nine workers who were employed as labourers, although some had completed trade

Table 6: Match between poster points and performance criteria for unit of competency: BCG2008 – Use explosive tools (1998) (1-2 of 5).

POINT ON POSTER	PERFORMANCE CRITERIA
Misfire: Do not remove tool from work surface for at least 10 seconds.	3.10. Misfire procedures carried out to manufacturer's recommendations and AS 1873 where required.
Minimum edge clearances: concrete and masonry – 75 mm, steel – 12 mm. AS 187	2.2. Minimum distances from edge of materials adhered to in accordance with
It a statutory requirement that all explosive cartridges be stored in a locked box in a secure area.	4.3. Charges stored in designated container in accordance with AS1983 and used charges recorded
Never use the tool in the presence of an explosive or flammable gas, dust or vapour or compressed air and never use it where the charge can be rendered dangerous by the presence of heat.	1.6. Safety hazards identified and correct procedures used to minimise risk to self and others.
Only load the tool at the worksite and immediately prior to use. Never fire on any readily shatterable surface, high tensile steel or any other unyielding substance. When an operator is firing into (or close to) wall, ceilings, floors, the areas above, below, or alongside the worksite must be barricaded off.	1.2. OH&S requirements associated with application tasks and workplace environment recognised and adhered to.
They must be cleaned every 100 shots and a log of maintenance must be kept.	5.2. Tool cleaned and lubricated to manufacturer's recommendation. 5.3. Periodic maintenance service carried out to manufacturer's specifications. 5.4. Log book checked and maintenance recorded to manufacturer's recommendations.
Warning signs are to be placed at all access points.	1.6. Safety hazards identified and correct procedures used to minimise risk to self and others.

apprenticeships, participated in this session. The strategies which the trainer used to enable learning were wide ranging and relevant to the task. They also reflected what would be perceived as *good practice* within the adult literacy field. The session was organised in two phases. In the first, the trainer provided a theoretical underpinning for the erecting of both steel and aluminium structures. This was accomplished in the following way. Firstly, there was a close integration of material aspects (for example, the individual scaffold

components) with their representations which were illustrated on the whiteboard as they were discussed. Secondly, there was a logical organisation of concepts and relationships that was developed along with the oral presentation that was used as a kind of "top level structure" to reiterate the critical points that were being made. Finally, the ANTA non-endorsed learning materials on scaffolding were provided as a resource for independent use by the participants.

In the second phase, the trainer used sophisticated modelling techniques and a staged process of developing independent skills in an almost seamless integration of theory and practice to effect the learning. One of the participants, in a follow-up interview, when reflecting on this session, claimed that although he preferred to learn solely by practical demonstrations, the initial theory session was crucial in ensuring that he *"didn't get lost"* when he engaged in a practical phase. He concluded that, *"it's a lot to take in"* but *"the prep is the way to go"*.

Two examples of a 'bolted-on' approach to the integration of literacy/numeracy competencies

At a number of motorway sites, an adult literacy and numeracy program was implemented to develop explicitly the competencies that underpinned a number of 'technical' competencies. As previously mentioned, this program was funded by the Building and Construction Industry Training Fund and delivered by an external provider using TAFE language and literacy teachers. Two sessions at Site B, one literacy and one numeracy, were observed. The literacy session was based on helping students comprehend the non-endorsed learning materials focusing on the safe usage of oxyacetylene equipment. The numeracy session focused on developing the concept of volume where formulae to solve 'technical' problems that feature in the work of civil construction practices were applied. Following are a number of strategies that were implemented to assist workers to use successfully the company training materials relating to the topic or oxyacetylene use.

- Articulation by the students of their prior learning through the use of questioning and labelling processes. Firstly, students were questioned about oxyacetylene practices in their workplaces, the meaning of the term 'oxyacetylene', and their experience in using such equipment. Secondly, they were asked as a group, to label a transparency depicting an acetylene cylinder and an oxygen cylinder, images from the training materials. The terminology used by the students was then compared to that used in the training materials. (See diagrams in Appendix F.)
- Reading for meaning. In this learning activity, the workers were asked to read one of four separate handouts on the topic of oxyacetylene processes and equipment (adapted from Performance Training Pty Limited, p. 2.1) and complete a worksheet based on their reading. (See Appendix G for copies of these handouts and the response by one participant.) The responses were then discussed among the workers present as a group, which included the literacy teacher. They were then collated on a

whiteboard copy of the table and discussed.

- The highlighting and discussion of "awkward" spellings of content words and patterns that these words represented.
- A review exercise. Workers were asked to match beginnings and endings of sentences to construct content meaning.

The strategies used in these training sessions were somewhat different from those used in the scaffolding one. These were more paper-based, required the participants to draw upon their prior knowledge in an explicit way, provided an opportunity for workers to share their knowledge about the topic amongst themselves as well as in a more collective sense, and were less dependent on the expertise of the presenter. Despite these differences, however, the strategies used by both trainers were effective in ensuring that the content of the units of competency that were being delivered were understood by the participants, despite their varying literacy and numeracy abilities.

5. Interview with two literacy/numeracy external trainers working on motorway site

A number of points that resonate throughout this report were expressed by the adult literacy/numeracy teachers during this interview. These points are listed and elaborated below.

- The lack of importance placed on integrating literacy and numeracy with technical training. The following quotes reflect the teachers' perspective.

  > *Certainly on the part of the trainers, there was no sense of integrating. I think it was going back to an older form of literacy and numeracy in the workplace...And all of the problems that we've had, with the logistics and everything, were all related to that: the problems of timetabling, of people turning up for classes, of people who volunteered initially and then didn't follow that through. They were all related to having these classes for people who had* ***problems*** *(our emphasis). The foremen, none of the supervisory staff really had much of a clue about the classes so there was no culture, really. Whereas, the attitude of the trainers or the people who wanted to put this into place was that it was the beginning; that this is a start. (but) it was the beginning of a* ***deficit*** *(our emphasis) culture and they couldn't really see that so there's a whole conceptual change that needs to take place.*

  > *Although the guys that I taught were all interested and motivated, it was more from a personal point of view. As far as filling in hazard report forms and stuff like that, they regarded it as an exercise, like an intellectual exercise. It was good to think again. It was good to do these things (but) they weren't really that interested in doing it for the job.*

- One exception to this situation was mentioned, however. This related to a

worker who was completing a dogger's course. In this case, it was noted that a "kind of bolt it on" approach of substantially reduced length might have been effective as this worker's needs were limited to the revision of subtraction and multiplication applications.

- Although these teachers were using texts from the industry training materials, they were aware that they were 'outsiders' contracted to 'fix' a perceived worker deficit. They suggested that a partial solution to the integration problem would be to employ an enterprise-based teacher. It was believed that a literacy/numeracy trainer working across the various motorway sites would then be available to deliver training as required.
- In addition to incorporating training requirements into civil construction contracts, which occurred in the case of the motorway, the teachers believed that it was important to work with front-line managers as well as trainers to develop a **'learning culture'** and establish systems that ensured that training was implemented throughout all levels of a company. They concluded that *"a teacher floating around on a motorway isn't necessarily going to do a lot unless you've got some support from a long way up and you've got a management style that suits"*.

6. Interview with employees regarding their training

In an interview with two labourers who had undertaken two types of training during the course of the ALNARC project: a scaffolding course, where literacy and numeracy competencies were *built-in*, and a literacy and numeracy course, where they were much more *bolted-on*; the following points were made.

- Most industry training could not be applied in their day-to-day work because of the latter's repetitive and bounded nature. With respect to the scaffolding course, however, they could see its application in bridge construction (an activity in which neither was presently engaged) and as a component of a labouring role, in general. However, the plan reading course they had completed appeared to be irrelevant, because only *"office"* workers such as engineers and supervisors used plans on a regular basis. One worker noted, though, that he uses a small section of a plan to construct drains.
- The workers seemed unfamiliar with the concept of competency based training and saw little relevance in gaining endorsed competencies if these were not required in their jobs. In their view, this seemed unlikely at present and in the future.
- One worker had attended the numeracy component of the literacy/numeracy course, while the other had participated in both literacy and numeracy sessions. They both felt they had benefited from this participation but only in a general sense. They saw little relationship between the practices in the training room and their own work practices. They also didn't see that there was any need for the off-site trainer to understand their work practices. They believed the development of such

understanding as an impossible task as the on-site trainer would not have the time to develop the necessary situated knowledge. Ultimately, they saw the literacy/numeracy training as being similar to school learning.

- On a number of occasions, they emphasised the importance of *"experience on the job"*. This resulted from *"observing the guys and listening to them"* and when moving from one crew to the next, the learning of new skills. They also recognised the variability between workers in accomplishing tasks but saw this as a strength. Again, these differences were attributable to years of experience not 'literacy' skills. A similar way of learning was employed throughout one's life. This is exemplified in the following quote.

  > *Like all through your life you learn by watching. You copy. Life is done by copying. It's like pouring a gully box. You mightn't know the exact volume but you can estimate if you do it enough. That's basically what it is. You look at it and guess.*

  The interviewees also spoke of the importance of experience in completing application forms for employment and in decisions by companies to hire workers. No mention was made of certified skills. However, when questioned about the value of the theoretical introduction to the scaffolding course that had been conducted, there was a recognition of its value as a *"prep"* to practically erecting the scaffolding.
- Both workers believed there was a problem in being released from work to attend training. One, in particular, spoke of the tension he felt between his commitment to attend training, the expectations to attend held by the training organiser, the opposition from his foreman and the unfairness that resulted from one worker in a crew of four or five not pulling his or her weight. He believed that training on-site during rainy weather would solve this problem.

7. Interview with developers of training materials to be used as an alternative to the non-endorsed ANTA ones for the civil construction industry

A consortium of motorway companies, including the two that are the focus of this study, chose to invite a training company to develop a set of materials that would be more appropriate to a motorway setting than those available as part of the non-endorsed component of the civil construction industry training package. The process that was used in this initiative was that the training coordinator at Site A would act as a medium to relay information to the different parties. Thus, at a number of stages in the development of each module, a somewhat formal system was enacted whereby concepts were refined and materials edited to ensure that the final product would be acceptable to the companies. The following steps characterise how this process was implemented for each of the six units of competency at Certificate II level that had been produced at the time of the ALNARC study.

1. The nature and the scope of the project are agreed upon.
2. This is followed by a site visit by the materials developer to detail the requirements of the project and to collect relevant artefacts for inclusion in the final product or for reference purposes.
3. A draft set of materials is produced.
4. Materials are distributed to representatives of the different companies for review.
5. The reviews are collated and returned to the writers.
6. The materials are re-drafted and re-distributed as a final copy (Performance Training Pty Ltd, undated).

The materials are presented in four sections:

1. There is a descriptor section which covers aspects such as program aims, nominal duration for completion of the unit, prerequisites, learning outcomes, and so on.
2. Lesson plans are provided to assist trainers to present the materials in an interesting and consistent way. These are supported by overhead transparencies.
3. Reference material is included which is intended to be given to the trainee. This contains graphic illustrations, photographs and cartoons to assist in the retention of the information that is being presented and to ensure its accessibility. (A sample of such materials is available in Appendix H).
4. An assessment schedule is provided. This reflects the assessment recommendations in the evidence guide which promote the use of *practical* assessment forms. In addition, there are self-assessment questions inserted at relevant points in the program to ensure that underpinning knowledge and the desired skills are being learned.

These particular developers of training materials have had extensive experience in producing materials for NESB workers. As a result, the difficulties that non-English speakers may have in using the reference materials are recognised. So, the program developers have implemented two initiatives. Firstly, they are experimenting with more extensive use of cartoons and a diminution of number of words in the text. This initiative has been well received on-site. Secondly, they have begun to develop audio supports to the text in the form of micro compact disks which will be easy to transport. These are expected to be available for piloting early in 2000.

Emergent issues from Phase 2

A number of issues related to the provision of training became evident as the ALNARC investigation proceeded. The primary issues included: the effects of the inclusion of literacy and numeracy competencies in industry standards in training packages on the quality of learning and work outcomes; the commitment by the two companies in the investigation to progressively reward employees with competency credentials and also positively favour those with such credentials when employing workers; the nature of the work and the workforce; and the importance of contextualising training.

- **The effects of the inclusion of literacy and numeracy competencies in industry standards in training packages on the quality of learning and work outcomes**

In this study it was not possible to reach a definitive conclusion about the effects of the inclusion of literacy and numeracy competencies in the civil construction industry training package on the *quality* of learning and work outcomes for workers engaged in training. This was because the civil construction training package was only implemented in September 1999, over half-way through the ALNARC project period.

It was possible, however, to investigate the impact of the inclusion of these competencies on the ways that training programs were being planned and delivered as well as on how resources were being prepared.

- **The commitment to training by the motorway companies**

Each of the five companies involved in the motorway project employed at least one trainer on-site. Some of these trainers delivered the majority of the company training, while others coordinated training delivered by outside providers. The training officers met regularly to discuss issues of current relevancy. A defining feature of the two sites investigated was the commitment of the training officers to training up all of their workers ultimately to Certificate level III standard.

Another feature of this commitment resulted from the terms of the contract that the employers signed. Since 1993 a ten percent training hour provision for apprentices, trainees and cadets relative to the total number of hours worked on a project has applied to all State Capital Works contracts over $100,000. However, the compliance rate in 1999 was been poor. A recent review (2000) of this policy has recommended that the threshold of $100,000 be increased to $500,000 for civil construction projects and that sanctions against non-compliance be applied stringently. The motorway project has been exemplary in accepting a commitment to training and this is likely to continue in the future.

Trainers and managers at the two sites that were studied had responded to the inclusion of literacy and numeracy competencies in the civil construction training package in three ways. These were: through adopting pedagogical methods that assisted workers with limited literacy and numeracy skills to engage with the content of the unit of competency that was being delivered, that

is, through a *built-in* approach; through supporting the literacy and numeracy program that was being conducted on these sites, through a *bolted-on* approach; and through assisting the training materials developer to produce quality teaching and learning materials that were accessible to all workers, regardless of their literacy and numeracy skills.

- **The nature of the work, the companies and the workforce**

The competency standards for this industry have been developing since the early nineties and yet their take-up has been relatively slow. This is partly attributable to the fact that employees are hired for the life of each project, with each project varying in duration.

Another factor that characterises motorway work is the close relationship between weather conditions and material progress. In heavy rain, work ceases and because these companies cannot dismiss workers during this time, training is commonly conducted. However, when training is conducted at other times, it is often difficult to release workers to attend.

There are also differences across companies in their delivery and assessment programs. With respect to the two companies involved in the ALNARC study, both were committed to training, yet the larger one appeared to be more successful in implementing the endorsed competencies of training packages (see Appendix B).

Finally, some workers often perceive little benefit from attending training sessions. The career path from labourer to tradesperson or foreperson is often difficult to traverse and financial benefit accruing from further training and credentialling is often not evident. This situation may change in the future, however, as is discussed in the following issue.

- **The contextualisation of training**

During the interviews with trainers and workers, a consistent theme addressed was the necessity for trainers to be experienced in civil construction. One trainer, when asked whether he perceived any differences between teachers and trainers, claimed that *"trainers are teachers with experience"*. When questioned further, he did not accept that there was high value in the years of theoretical learning that many qualified teachers had achieved and the ways that this learning might have been used reflexively in their practices. Rather, for him, experience 'on the job' was the major defining feature of an excellent trainer.

Data from interviews with workers supported this belief, although there was also a conviction evident that some basic skills were transferable. While workers appreciated the opportunity to improve their literacy and numeracy skills, these were not always perceived to be related to their workplace practices. Workers appeared unfamiliar with the concept of competency based training per se, and saw little relevance in gaining endorsed competencies and underpinning literacy and numeracy competencies if these were not required in their current positions, or a likely future one. In addition, one of the trainers recounted that a worker had discontinued attending the numeracy program that was provided

because he wished to learn how to 'screen' sand in the preparation of concrete and the numeracy teacher did not understand this technique.

For over twenty years, adult literacy and numeracy researchers have emphasised the importance of situating learning within the context of its use. In a seminal study in Liberia, Scribner and Cole (1979) showed that different literate practices required knowledges that differed significantly from those traditionally taught in school. More recently, Zevenbergen (1995) has shown that the calculations that pool builders use to construct irregularly-shaped pools are not those conventionally learned in school for calculating volume.

This contextualisation issue has particular implications for adult literacy and numeracy teachers. Enterprise-based teachers are more likely to understand the culture of literate and numeracy practices in a specific environment, than other literacy/numeracy teachers who only train workers at a site on a limited basis. What is at question is the amount and depth of knowledge of the context that is necessary to ensure successful training.

- **The integration of literacy, numeracy and communication competencies into the civil construction training package**

While the integration of literacy, numeracy and communication competencies has usually been inserted into the civil construction training package in an integrated way, this is not the case for two elements of competency at Certificate level I, namely, *BCG1000 – Workplace communication and BCG 1004 – Carry out measurements and calculations.* Thus, it might be perceived that these two competencies are firstly, discrete; secondly, can be categorised in a similar way to the others that have been identified at this level, and thirdly, serve as pre-requisites to competencies at Certificate II and III levels in the package. We do not believe that it is appropriate that workplace communication and measuring and calculating should be considered in this way. Both competencies should occupy a similar position to other literacy, numeracy and communication competencies that are treated as underpinning skills and knowledge and are inserted implicitly within broader competencies.

Recommendations

In considering the data that have resulted, the following recommendations are made.

3. That there should be further research within the construction industry, across all levels (management to construction worker), to explore the commitment to the integration of literacy and numeracy in training and the development of a training/learning culture.
4. That further research be conducted regarding the strengths and weaknesses of 'built-on' and 'built-in' approaches to the incorporation of literacy and numeracy competencies into technical competencies. While adult literacy/numeracy researchers and trainers would favour an integrated approach to literacy and numeracy competencies, the ABS survey figures

(1966) indicate that the nominal hours that have been allocated for the acquisition of competencies may be inadequate because of the limited skills of construction workers.

5. That further research be conducted to identify models of good practice in the delivery of training based on the civil construction training package on motorway sites.
6. That further research be conducted into:
   a) the practices of making explicit the literacy and numeracy knowledge and skills that underpin technical competencies during assessment processes; and
   b) the identification of models of good practice in assessing this literacy and numeracy knowledge and these skills.
7. That in the next review of the civil construction standards framework, consideration be given to incorporating the following certificate level I units of competency into relevant technical units on the grounds that to separate these units provides a distorted view of their relevance to most other competencies:
   - BCG 100A: Carry out interactive workplace communication,
   - BCG1001A: Carry out OH&S requirements,
   - BCG1002A: Plan and organise work, and
   - BCG1004A: Carry out measurements and calculations.

5 Conclusions

This project was undertaken in order to contribute to a national study investigating the effects of the inclusion of literacy and numeracy competencies in industry standards in training packages on the quality of learning and work outcomes. In this Queensland study, data have been presented to provide a brief overview of the take up of training packages in general in Queensland, while a more detailed description of the how literacy and numeracy issues have been addressed within training programs on two motorway sites and by a civil construction training materials developer is also presented. While the study has examined the effects of the inclusion of literacy and numeracy in training packages on the *quality of learning* at these sites, it is too early to examine the quality of *work outcomes* ensuing from this inclusion.

Generally, it is noted, that there has been little formal implementation of the civil construction training package in Queensland. This can be attributed to the fact that the conditions surrounding the implementation of this package were not finalised until October 1999. At the company level, however, while trainees were not formally registered during the period of the study, training and assessment that was based on the civil construction competency standards were provided during this period.

With respect to literacy and numeracy competencies within the civil construction training package, it appears that for the most part that these competencies are seen as 'underpinning' knowledge and skills. Thus, with the exception of *BCG 1004A – Carry out measurements and calculations,* the integration of literacy and numeracy competencies is implicit. The implications of this are two-fold. Firstly, there is an assumption that if a worker is assessed as competent in relation to a 'technical' element, then he/she must have the associated literacy and numeracy competencies. Secondly, there is an assumption that workers have the required literacy and numeracy skills to access training. In this study we were able to report some examples of how companies on two sites dealt with these issues and it was apparent that at least some of the trainers were successfully integrating literacy and numeracy competencies into technical training. However, it would be interesting to see how typical these examples are of the broader training on the motorway projects. In addition, little examination of the assessment practices engaged in on these sites was undertaken. Thus, understandings of the ways that literacy and numeracy factors were considered in the assessment regimes of these companies needs further study.

There was a general recognition by those interviewed within the civil construction industry that literacy/numeracy competencies should underpin industry standards. While we have noted the recognition by the industry that many workers are likely to have inadequate literacy and numeracy skills, there exists a difference of opinion in how best to deal with this situation. Both a 'built-on' approach, using an external provider, and a 'built-in' approach relying on in-house trainers were adopted in the motorway project. From a pedagogical perspective both approaches appeared

to demonstrate examples of good practice. However, it would seem from the limited data available that the workers favoured the 'built-in' approach. This training was seen as being more relevant and a possible preparation for performance on-site. Although there did not appear to be any stigma attached to attendance at training sessions, the workers felt a number of tensions between their commitment to training, the responses by their supervisors and other workers and the expectations of trainers. Workers had to contend with opposition from supervisors, who themselves often did not appreciate the benefits of training per se, and the apparent unfairness when they withdrew from their specific workplace locations to attend this training, leaving the team one person fewer to engage in work activities. These issues would need to be addressed if training were to be made available to all workers.

Contractual training agreements with the state government ensured, it appears, that there was a genuine commitment to training on the part of the companies involved with the motorway project. However, there was a tension between this commitment to training and the main objective – that of completing the motorway project on time and within budget. This can translate into training being conducted on wet days or when otherwise convenient. A second tension may exist between the commitment of management and trainers to the development of a 'training culture' and the ambivalence of workers. While there was a training commitment for all workers to achieve Certificate III within a number of sectors of the industry, the workers themselves did not always believe that there was any direct benefit to themselves. They did not necessarily see the training pathways which that have been developed for the industry, neither did they always associate training with on-the-job performance. Learning for them may have been perceived as best achieved by observation of experts on the job. Further, additional qualifications were not likely to result in increased pay or conditions in the short term. While data have been presented to show that the number of competencies being achieved by workers on the motorway project, either through recognition of prior learning or as a result of industry training was substantial, it is too soon to tell if this has resulted in improved work outcomes.

Finally, there has been a trend for increased skill development to take place in the workplace. Partly, this it is seen as being cost-effective, but it is also believed to make a positive contribution to improved staff relations, motivation and productivity through building 'communities of practice'. However, such an approach has both strengths and weaknesses as demonstrated in research by Billett (1996) and Harris and Volet (1997). For example, while some knowledge may be readily accessible in the workplace, other concepts require some form of instruction for their acquisition. The importance of this for the current research is that often classroom activities are quite distinct from those which occur in the workplace (a fact not unnoticed by the workers who were interviewed) but that does not mean that that they are not valuable in providing structured learning. What is required is a greater understanding of how each of these learning environments contributes to the overall learning and work outcomes in the construction industry.

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7 Appendices

Appendix A: Interview Schedules

Appendix A(1): Questions to address to trainers

(not necessarily in this order)

1. Background information:
   - What qualifications and experience do you have as a trainer?
   - In particular, in the civil construction area?

2. Do you use any of the resources that have been developed to support the Civil Construction Training Package?
   - If yes, which ones? Do you use additional materials? What is the source of these?
   - If no, why is this? What is the source of your materials?

3. In basing your training on the competencies within the Civil Construction Industry Training Package standards, which competencies do you train to?

4. There has been a concern by ANTA to recognise the underpinning literacy and numeracy competencies in the standards that are endorsed in Industry Training Packages. These are sometimes made explicit but in other cases, they remain implicit. Do you think there are any literacy/numeracy competencies that are made explicit within these? Which ones?

5. How do you take into consideration these literacy and numeracy competencies:
   - in planning your courses?
   - in delivering your courses?
   - in assessing your courses?

6. Do you take the literacy and numeracy ability of the trainees into consideration when delivering training? Give examples.

7. In the future, do you envisage that industry standards as in the packages will become more important? What will this mean to employers? Trainers? And workers? What will be the literacy/numeracy implications for this development?

Appendix A(2): Questions to address to workplace teachers

(not necessarily in this order)

1. Background information:
   - What qualifications and experience do you have as a workplace literacy/numeracy teacher?
   - In particular, in using industry training packages?

2. What were your expectations when you agreed to teach on this project? For example, how did you approach the teaching of the course?

3. How useful in planning your program was the information documented from the initial interview?

4. How closely aligned is your program to the day-to-day work that the workers do?

5. How closely aligned is your program to the Civil Construction competencies? If there is alignment, can you give me some examples?

6. How closely aligned is your program to the contextual demands of the workplace, e.g., workplace health and safety issues? If there is alignment, can you give me some examples?

7. Do you know how this course fits into the wider training framework used on this site?

8. Have you planned the course in an overall way or do you plan from week to week?

9. Where do the materials for your classes come from?

10. What are some of the strengths of the course?

11. What are some of its weaknesses?

12. Are there improvements that could be incorporated into another such program with civil construction workers on a motorway?

Appendix A(3): Questions to address to workers

(not necessarily in this order)

1. How did you hear about this course?

2. Why did you volunteer for this course?

3. What have you found useful about it?

4. What has not been so useful?

5. Do you think what is covered is related to what you do at work? If so, give examples.
   Follow-up:

   Do you think being able to . . . saves time on the job? Example

   Do you think being able to . . . saves injury on the job? Example

   Has anyone noticed that you can do . . . better?

6. If another literacy/numeracy course that was based on work activities was offered in work time, would you enrol? Why?

7. How might a similar course be improved?

8. What did you think of the initial assessment that was done before the course started? It took about an hour. Was that okay? What about the things you were asked to do? Were they okay? How could the assessment have been improved?

9. Have you participated in other training courses? If so, what? ***Why did you choose this course/these courses? (Omit unless different from Q.1)*** How did the presenter(s) ensure that everyone was coping with the course?

10. How were you assessed? Was this satisfactory? If not, how could the assessment process be improved? ***Does this relate to Q.7 or to summative assessment?***

    What do you think you can do now that you couldn't when you first started the course? How do you know? Did anyone give you a formal assessment? Then Q.9.

11. Are you doing any other training? If yes, how does the literacy course relate/assist/help with this training?

Appendix B: Civil Construction Competency Acquisition

by Workers At Site A

Appendix B(1): Civil Construction Level 1 Competency Acquisition at Site A

Core competencies =

Element of competency	Nominal training hours	RPL	Acquired on job	Trained but not assessed	Partially acquired
BCG1000 – Workplace comm'n	24	91			2
BCG1001 – OHS	32	88	1		2
BCG1002 – Plan/organise work	16	89			2
BCC 1003 – Drain/dewater site	32	64	28		1
BCG1004 – Measure & calculate	8	59	23		4
BCC 1005 – Use hand power tools	16	90	1		1
BCC 1006 – Use small plant & equipment	32	92			
BCG 1007 – Scaffolding	40	3	7		
BCG 1008 – Simple levelling devices	8	69	4		2
BCC 1009 – Manual excavation	8	71	4		3
BCG 1010 – Concreting to simple forms	8	59	2		4
BCG 1011 – Construction materials	8	72	11		2
BCG 1012 – Compact materials	8	67	5	14	2
BCC 1013 – Monitor machine operations	8	63			5
CC 1014 – Control construction traffic	16	29	53		2

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Appendix B(2): Civil Construction Level II Competency Acquisition at Site A

Core competencies =

Element of competency	Nominal training hours	RPL	Acquired on job	Trained but not assessed	Partially acquired
BCC 2000 – Read & interpret plans	32	18	55	5	
BCC 2001 – Carry out basic site survey	40	37	18	30	2
BCG2002 – Oxy/LPG acetylene cutting	32	13	36	16	2
BCC 2003 – Assist with excav'n & support instal'n	32	64	4		2
BCG2004 – Lay pipes	32	29		3	3
BCC 2005 – Repair pavements	24	39	27	15	1
BCG 2006 – Erect/dismantle fences & gates	16	6	54	7	
BCG 2007 – Operate elevating work platforms	16	2			
BCG 2008 – Use explosive power tools	16	12	54	7	
BCC 2009 – Carry out concrete work	24	41			4

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Appendix B(3a): Civil Construction Level III Competency Acquisition

(Pipelaying) at Site A

Core competencies =

Element of competency	Nominal training hours	RPL	Acquired on job	Trained but not assessed	Partially acquired
BCC 3030 – Install drainage & pipeline systems	80	2	2		
BCC 3031 – Maintain drainage systems	32	2			
BCC 3034 – Apply bitumen seal	72				
BCC 3036 – Spread &compact granular materials	80	9	2		
BCC 3037 – Place kerb, channel, median & barrier strips	40				
BCC 3038 – Lay segmental/ unit paving	24	1			
BCC 3039 – Apply road markings	32			1	
BCG 3040 – Install & maintain signage & roadside fixtures	24	4			3

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Appendix B(3b): Civil Construction Level III Competency Acquisition

(Plant) at Site A

Core competencies =

Element of competency	Nominal training hours	RPL	Acquired on job	Trained but not assessed	Partially acquired
BCC 3002 – Conduct backhoe/ loader operations	320	1			
BCC 3003 – Conduct dozer operations	320	3			
BCC 3004 – Conduct excavator operations	320	5			
BCC 3005 – Conduct front end loader operations	320	9	1		
BCC 3006 – Conduct grader operations	320	6			
BCC 3007 – Conduct scraper operations	320	1			
BCC 3008 – Conduct skid steer loader operations	320		1		
BCC 3018 – Conduct materials spreader operation	320	3			
BCC 3009 – Conduct roller operations	80	15	2		1
BCC 3010 – Conduct water cart operations	80	2	1		
BCC 3012 – Conduct dump truck operations	80	1	1		
BCC 3013 – Conduct forklift operations	80	3	1		
BCC 3016 – Conduct soil & landfill compactor operations	80	8			

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Appendix B(3c): Civil Construction Level III Competency Acquisition

(Road Construction) at Site A

Core competencies =

Element of competency	Nominal training hours	RPL	Acquired on job	Trained but not assessed	Partially acquired
BCC 3028 – Control traffic	40	8	60	8	
BCC 3030 – Install drainage & pipeline systems	80	2	2		
BCC 3031 – Maintain drainage systems	32	2			
BCC 3032 – Prepare road sub-grade	40	5	3	7	
BCC 3034 – Apply bitumen seal	72				
BCC 3035 – lay asphalt	72				
BCC 3036 – Spread &compact granular materials	80	9	2		
BCC 3037 – Place kerb, channel, median & barrier strips	40				
BCC 3038 – Lay segmental/ unit paving	24	1			
BCC 3039 – Apply road markings	32			1	
BCC 3040 – Install & maintain signage & roadside fixtures	24	4			3
BCC 3041 – Maintain sealed roads	24	4			

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Appendix B(3d): Civil Construction Level III Competency Acquisition

(Bridge/Marine Construction & Maintenance) at Site A

Core competencies =

Element of competency	Nominal training hours	RPL	Acquired on job	Trained but not assessed	Partially acquired
BCC 3028 – Control traffic	40	8	60	8	
BCC 3050 – Construct sub-structures - bridges & wharves	160	4			
BCC 3051 – Install deck	80	5	12		2
BCC 3052 – Maintain structures - bridge & marine works	80	2			

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Appendix C: Explosive power tools poster

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Appendix D: Scaffolding Unit of Competency

UNIT OF COMPETENCE BCG1007: ERECT AND DISMANTLE RESTRICTED HEIGHT SCAFFOLDING – Element, performance Criteria and Evidence Guide

Element of Competency	Performance Criteria
1. Plan and prepare work	1.1 OH&S requirements with the application tasks and workplace environment recognised and adhered to
	1.2 Location and scope of scaffolding/equipment determined from job drawings or supervisor's instructions
	1.3 Appropriate personal protective equipment selected, correctly fitted and used
	1.4 Tools and equipment selected consistent with job requirements, checked for serviceability and faults reported to supervisor
	1.5 Scaffolding/equipment components selected consistent with the requirements of the job
2. Erect safety barriers	2.1 Safety barriers erected, where applicable, to isolate site work area
	2.2 Relevant signage installed, where required, to OH&S requirements
3. Erect scaffolding	3.1 All work undertaken safely and to supervisor's prescribed procedures
	3.2 Erection site prepared to meet job requirements
	3.3 Necessary signage prepared to meet job requirements
	3.4 Scaffolding/equipment erected to plan, in accordance with safe work practices, OH&S and manufacturer's requirements
4. Dismantle scaffold	4.1 Work undertaken safely to reverse procedures for erecting
	4.2 Scaffolding/equipment dismantled in accordance with site procedures and critical structural safety
5. Clean up	5.1 Site cleaned and cleared of all tools, excess material and waste and left in safe condition
	5.2 Tools and equipment cleaned, maintained and stored

Evidence Guide

Competency is to be demonstrated by the safe and effective erection and dismantling of different types of restricted height scaffolding within the range of variables statement relative to the work orientation.

Critical Aspects of evidence

It is essential that competence is observed in the following aspects:

- demonstrated compliance with Occupational Health and Safety regulations applicable to workplace operations.
- indicate compliance with organisational policies and procedures including Quality Assurance requirements
- correct procedures carried out prior to and during the application of construction process
- demonstrate safe and effective operational use of scaffolding tools and equipment
- scaffolding erected, plumb and braced for stability
- interactive communication with others to ensure safe and effective erection and dismantling

Underpinning knowledge and skills

Knowledge

A knowledge of:

- workplace and equipment safety requirements
- scaffolding and basic working platforms
- hand tools
- materials
- materials handling
- vertical and horizontal concepts.

Skills

The ability to:

- work safely to instructions
- use hand tools
- handle material
- select material
- communicate effectively.

Appendix E: Scaffolding assessment materials

OBSERVATION CHECKLIST

MODULE: RESTRICTED HEIGHT SCAFFOLDING

ELEMENT	PERFORMANCE CRITERIA	RESULT
Plan job	Location of scaffold is confirmed Hazards are identified Scaffold components selected Personal protective equipment worn Area is clear of rubbish and material	
Prepare site for erection	Area is isolated Signage is erected Adequate footings are established Overhead powerlines are identified	
Erect scaffolding	Correct components are used Correct sequence is used Scaffold is levelled and braced Handrails are in place Access is used Scaffold is tied off Toe boards and brick guards are in place	
Dismantle scaffold	Correct sequence is used Barriers are in place Signage is in place Gear is stacked correctly	
Clean up	Area is checked for all components All excess material is removed	

Comment: _____

_____

_____

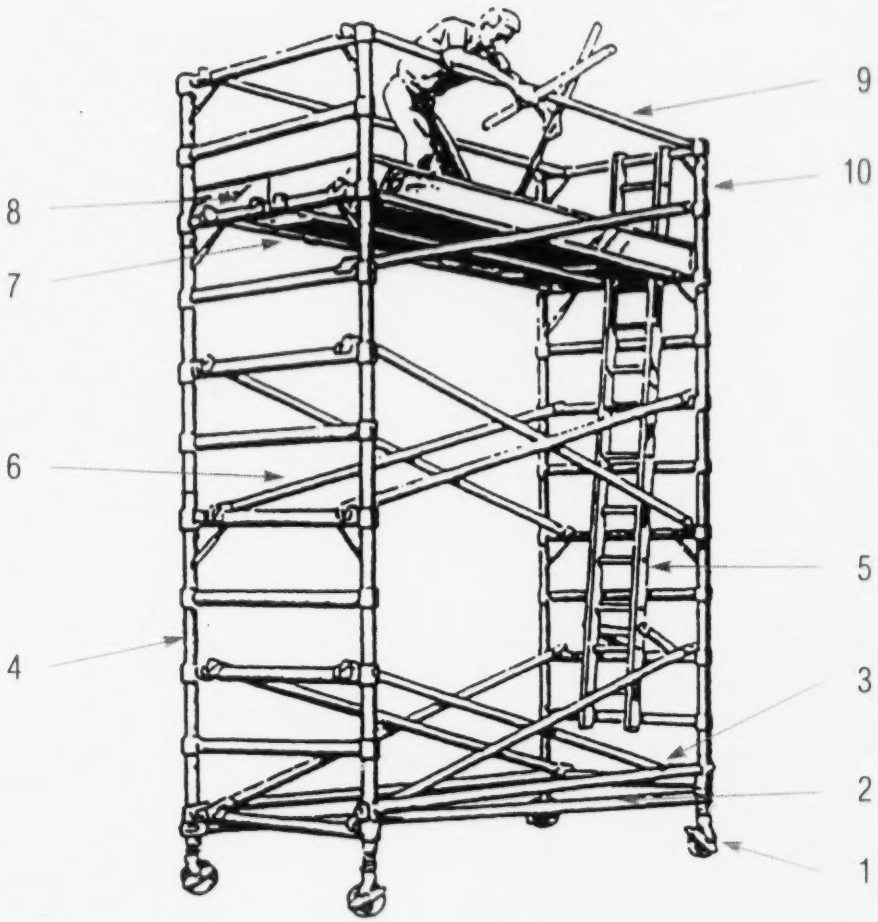
_____

Assessor Name: _____ Signature: _____

Assessee Name: _____ Signature: _____

Date of Assessment: _____

Appendix E: Scaffolding assessment materials
(continued)



Name the members circled

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

7 _____

8 _____

9 _____

10 _____

Appendix E: Scaffolding assessment materials (continued)

RESTRICTED HEIGHT SCAFFOLD

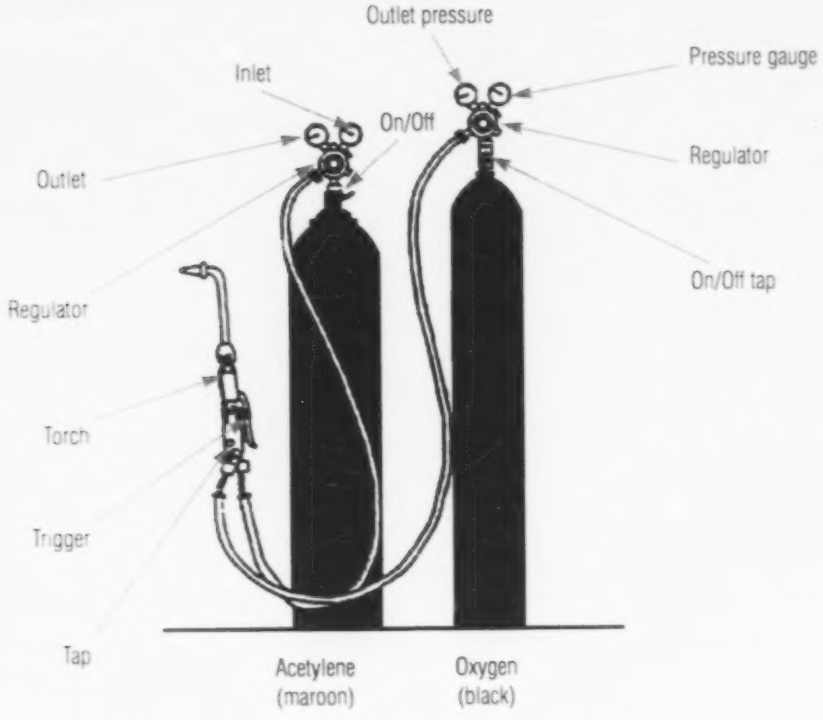
BCG.1007 Erect and Dismantle Restricted Height Scaffold

WRITTEN ASSESSMENT

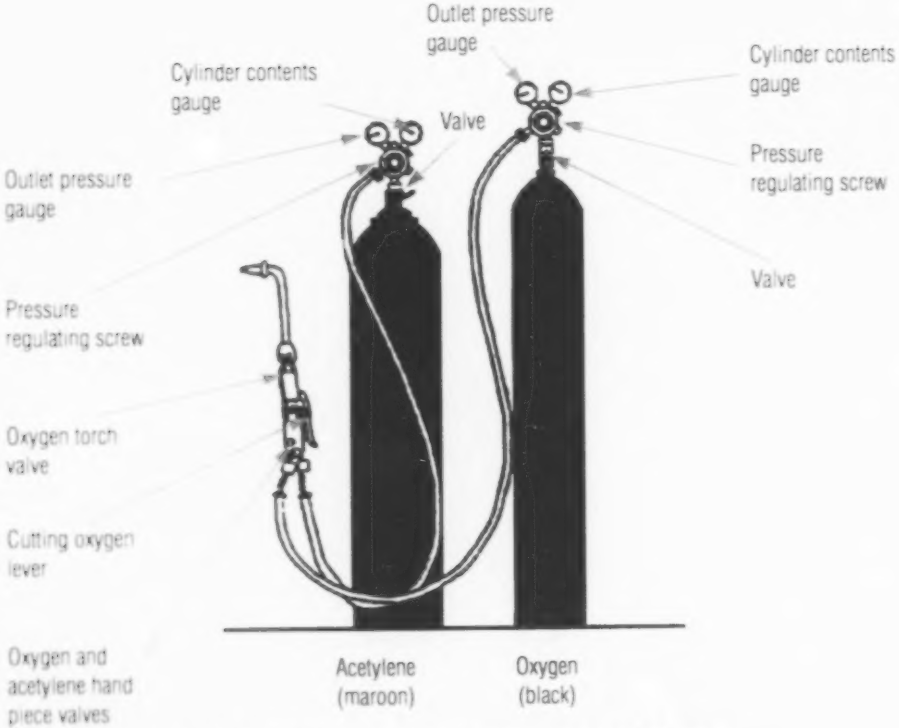
No	QUESTION	RESULT
1	At what height is a scaffolding certificate required? a. 4 m b. 5 m c. 6 ml	
2	When are handrails and edge protection needed on working platforms?	
3	What is the minimum height of edge protection required on a working platform?	
4	What is the minimum thickness of an oregon timber scaffold plank? a. 32 mm b. 38 mm c. 50 ml	
5	Where would you fix the ladder access to an aluminium mobile scaffold? ☐ Internal ☐ External	
6	When a scaffold is built on soil, what would you place under the base plates to distribute the load?	
7	What is the minimum number of planks on a light scaffold?	
8	The minimum height for a hand rail is between 900mm – 1100mm ☐ True ☐ False	
9	Metal scaffold can not be erected within 4 m of live unprotected power lines? ☐ True ☐ False	
10	What is diagonal face bracing used for?	

Answers

Appendix F: Comparison of diagrams of oxyacetylene equipment



OXYACETYLENE WELDING EQUIPMENT



OXYACETYLENE WELDING EQUIPMENT

Appendix G: Oxyacetylene process and equipment handouts, response sheet and review exercise

OXYACETYLENE PROCESS AND EQUIPMENT

INTRODUCTION

For many maintenance and production applications, the gas flame process still gives the most suitable combination of properties. Oxyacetylene gives the most versatile combination for welding, brazing and cutting. Although there are alternative combinations to perform the same tasks, we will be concerned only with oxygen and acetylene.

OXYACETYLENE FLAME PROCESS

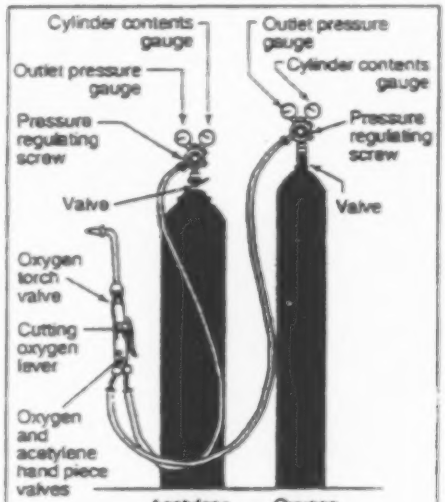
The oxyacetylene flame process combines oxygen and acetylene gases to provide a high temperature flame for welding and metal cutting. This flame provides heat to melt most metals.

GAS FLOW PROCESS

Oxygen and acetylene are supplied from separate cylinders. Each cylinder must be equipped with a pressure reducing regulator incorporating high and low pressure gauges.

The high pressure gauge indicated the pressure in the cylinders. The low pressure gauge indicates the pressure of the gas being fed to the torch.

Separate flexible hoses carry the gases to the torch. The torch has two needle valves. One torch valve controls the rate of flow of the acetylene while the other controls the oxygen. The mixed gases burn at the torch tip orifice (opening).



OXYACETYLENE WELDING EQUIPMENT

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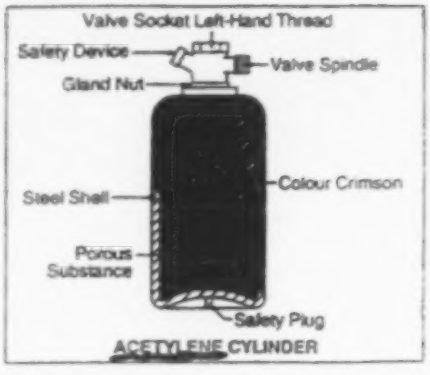
Appendix G (continued)

ACETYLENE CYLINDERS

Acetylene cylinders have the following characteristics:

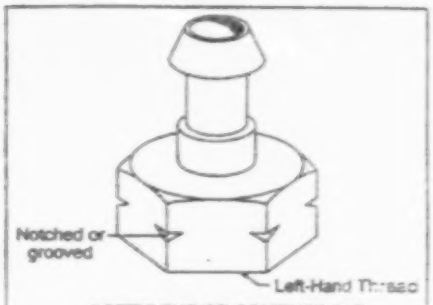
- coloured crimson
- the valve outlet has a left-hand thread and is fitted with a valve spindle to turn pressure on and off (normal pressure is 1 750 kPa). Safe operating pressure is approximately 70.5 kPa and must not exceed 103.5 kPa.



ACETYLENE CYLINDER

- the cylinder is protected from explosion by safety fusible plugs which melt under excessive heat and allow the pressure to be released.
- acetylene cylinders have left-hand threaded connections which are notched or grooved.

All cylinders are seamless and heat treated to ensure they are strong enough to stand up to abuse during use and transportation.

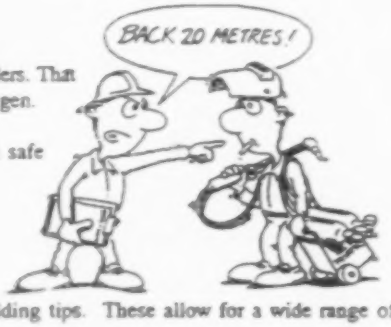


ACETYLENE OR COMBUSTIBLE GAS CONNECTION

HOSES

Oxyacetylene hoses are colour coded to match the cylinders. That is, crimson hoses for acetylene and black hoses for oxygen.

Hoses should be long enough for the torch to be a safe distance from the cylinders.



WELDING TORCH AND TIPS

Oxyacetylene torches come with a selection of welding tips. These allow for a wide range of heating flames.

The torch has a hand piece with separate inlet connections for the two gases. Each inlet has a valve that controls the amount of oxygen or acetylene passing through it. By adjusting these valves the volume of each gas entering the mixing chamber can be controlled. Once in the chamber the gases are thoroughly mixed before being released through the tip or nozzle.

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Reading exercise: Read the description of the element that you are given, and complete the boxes with short notes. Then find out the differences between all the elements by asking the others questions on the element they read about.

	Gas flow regulators	Acetylene Cylinders	Oxygen Cylinder Gas flow regulators	Hoses	Welding torch & tips
Colour?	Black and crimson	Crimson	Black	Black and crimson	
Thread?	Right and left	Left hand thread notched, grooved	Right hand	Left hand set Right hand Oxy	
Valve?		Valve spindle to turn pressure on and off	Valve spindle to turn pressure on and off		2 valve to control the mixing of gas
Pressure?		Normal pressure 1750kPa Safe 70.5 to 103.5kPa	15180kPa		
Safety?	Relief valves Release excessive pressure	Fuseage plugs which Melts under heat and allows pressure to be released	Disc which burst under excessive pressure	Hoses long enough	

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Appendix H: Sample materials by Performance Training Pty Ltd

RING ROLLER MILL

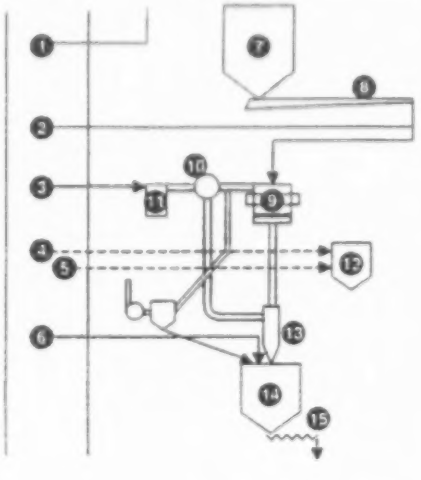
INTRODUCTION

This topic introduces trainees to the second stage of the product finishing process, the ring roller mill (RRM). Trainees will learn about the purpose of the mill, the detailed operation, walkaround inspections, and troubleshooting. An assessment at the completion of topic three will check trainees knowledge of the process.

OVERVIEW

The objective of the ring roller mill is to grind EMD chip into a fine powder that is within a size range specified by the customer. Specifications vary from customer to customer, so the ability to control particle size is an important factor in the operation. These variations are controlled by the RRM whizzer, or separator, and by controlling air flows within the process.

Ground product travels to a storage bin via the RRM cyclone, or mill classifier, where EMD powder is separated from the mill air circuit. The function of the RRM baghouse is to remove dust laden air from the circuit.



RING ROLLER MILL

1. Overflow to Pond
2. Chips to Chips Bagging
3. Gas
4. Reclaim and Renvac
5. Oversize from MP04
6. Reclaim Bags
7. 500BN01 Ring Roller Mill Bin 300T
8. 500FE01 Tube Conveyor
9. 550ML01 Ring Roller Mill
10. System Fan
11. Air heater
12. 550BN06
13. 550CS01 Mill Classifier
14. 550BN04 Fines wash feed bin
15. 550FE01 Screw feeder

RING ROLLER MILL PROCESS FLOW SCHEMATIC

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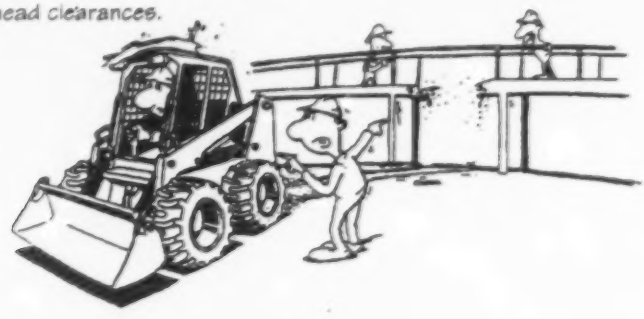
Appendix H (continued)

Topic Five — Bobcat Operations

Overhead clearances:

- watch for overhead clearances.

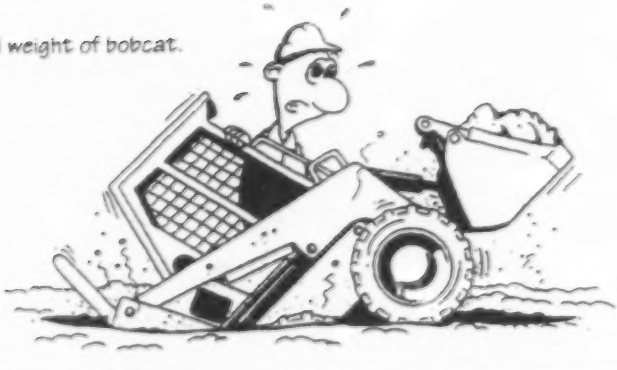


Visibility:

- check around the bobcat.

Weight:

- check ground and weight of bobcat.

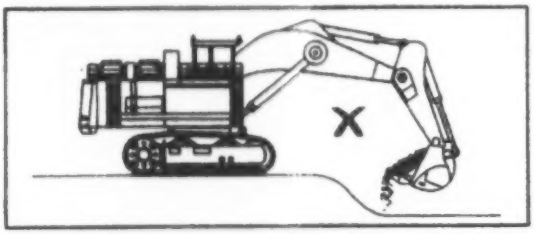


Appendix H (continued)

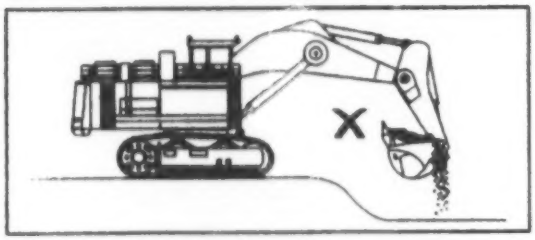
Raising the Bucket

Once the bucket is full, the following techniques for raising the bucket should be carried out to minimise material spillage and equipment damage.

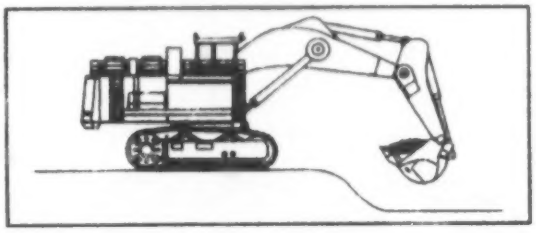
- If the bucket is not curled in enough, material will fall over the bucket teeth.



- If the bucket is curled in too far, material will fall over the back of the bucket and crush between the bucket and stick.



- The ideal position of lift and carry is to curl the bucket to enable maximum fill with no spillage for maximum efficiency.



SWINGING PHASE

Haultruck spotting time and swing arc create the greatest production difference. The steps of the swinging phase are to control the position of the bucket in a planned swing arc (path). Correct swing motion means smooth control and efficient swing control. The swing motion is commenced towards the haultruck when the bucket is full and is clear of the bench. The swing motion begins with smooth acceleration to an optimum point at which the excavator is plugged to a stop over the haultruck. Maximum efficiency and minimum swing machinery wear are direct results of mastering the swing motion.

SWING PHASE

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